TOSHIBA

2006-12

PRODUCT GUIDE

LED Lamps



semiconductor

http://www.toshiba-components.com

BCE0006C:0612(D)

CONTENTS

For other LED product guides, e.g, the LED Lamps Application Guide, please visit the Toshiba Web site at **http://www.semicon.toshiba.co.jp/eng/**

Overview of Toshiba's Visible LED Lamp Family

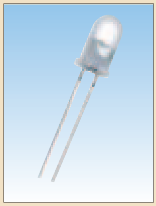
LED Lamp Family

High-Brightness Through-Hole Type

InGaAℓP
- TL*K Series
- TL*H Series
- TL*E Series
- TL*U Series

InGaN
- TL*C Series

- The four-element (InGaAℓP) LED lamps ranging from the TL*H Series, which offers the brighest luminous intensity level in Toshiba LED lamps, to the TL*U Series, which is for general-purpose applications.
- Package: ø5 mm, ø3 mm, oval
- For ø5 mm packages, LED lamps with and without standoffs are available. (Suffix P in the part number indicates an LED lamp without standoffs.)



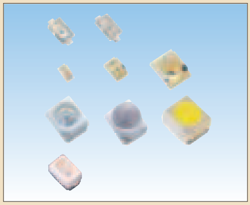
SMD Type

InGaAℓP
- TL*H Series
- TL*E Series
- TL*F Series
- TL*V Series
- TL*U Series

InGaN
- TL*E Series
- TL*D Series
- TL*C Series
- TLWJ1100

GaN
- TL*A1100 Series
- TLWH1100

- Package size: 1.6 x 0.8 mm
  2.0 x 1.25 mm
  3.2 x 2.4 mm (ø2 lens-top type)
  2.0 x 1.4 mm
  3.2 x 2.8 mm (flat-top type / ø3 lens-top type)



Product Number Format

Through-Hole Type I (three-digit package number)

The part number for through-hole type I consists of the following six groups of alphanumeric codes.

Part number: TL □ ○○○ □ □ (F)
(the three boxes after the package number are marked *, **, ***)

- TL: Toshiba LED
- □: Color symbol (See page 8.)
- ○○○: Three-digit package number

* Revision code
** P is suffixed for LEDs without standoffs (for ø5-mm packages only).
G is suffixed for LEDs that can be mounted flush on a PCB.
*** Lead(Pb)-free lead finish

Example: TLSU113P(F)
- High-brightness TLSU Series LED without standoffs
- Package number: 113
- Lead(Pb)-free lead finish

Example: TLSU113(F)
- TLSU Series LED with standoffs
- Package number: 113
- Lead(Pb)-free lead finish

Through-Hole Type II (two-digit package number)

Recommended !

The part number for through-hole type II consists of the following six groups of alphanumeric codes.

Part number: TL □ ○○ □ □ (F)
(the three boxes after the package number are marked *, **, ***)

- TL: Toshiba LED
- □: Color symbol (See page 8.)
- ○○: Two-digit package number

* Lens type T: Transparent C: Colored, transparent D: Colored, diffusing M: Milky white, diffusing
** P is suffixed for LEDs without standoffs (for ø5-mm packages only).
G is suffixed for LEDs that can be mounted flush on a PCB.
*** Lead(Pb)-free lead finish

Example: TLRME68TG(F)
- High-brightness TLRME Series
- Transparent lens
- Package number: 68
- Can be mounted flush on a PCB.
- Lead(Pb)-free lead finish

SMD Type

Recommended !

The part number for an SMD type consists of the following five groups of alphanumeric codes.

Part number: TL □ ○○○○ □ (T□)

- TL: Toshiba LED
- □: Color symbol
- ○○○○: Four-digit package number
- □: Revision code
- (T□): Tape specification

Example: TLYU1008A(T04)
- High-brightness TLYU Series with tape and reel suffix T04
- Package number: 1008A

※ TL*V1022 Series

Part number: TL □ ○○○○ (T□, F)

- TL: Toshiba LED
- □: Color symbol
- ○○○○: Four-digit package number
- T□: Tape specification
- F: Lead-free lead finish

Example: TLRMV1022(T14,F)
- High-brightness TLRMV Series with tape and reel suffix T14
- Package number: 1022
- Lead(Pb)-free lead finish

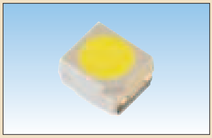
1. New Product Digest

1. High-Brightness White Surface-Mount LED Lamp — TLWJ1100

A highly efficient blue chip and an optimized phosphor have enabled the TLWJ1100 to achieve a luminous intensity around 1.7 times greater than that of the TLWH1100, Toshiba's previous LED lamp.
The TLWJ1100 is used in a wide range of applications, from general-purpose applications such as light sources for equipment switches and backlighting to automotive applications

Features

- High-brightness and clear white color
- PLCC-2 package (3.2 (L) x 2.8 (W) x 1.9 (H) mm)
- Operating temperature range: –40˚C to 100˚C (@ I_F = 15 mA)



Applications

- Backlighting for car interiors and various switches
- Pilot lamps

Absolute Maximum Ratings (Ta = 25˚C)

Characteristic	Symbol	Rating	Unit
Forward Current (DC)	I_F	30	mA
Allowable Power Dissipation	P_D	120	mW
Operating Temperature	Topr	–40 to 100	˚C
Storage Temperature	Tstg	–40 to 100	˚C

Optical and Electrical Characteristics (I_F = 20 mA, Ta = 25˚C)

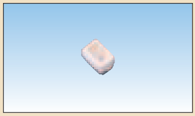
Part Number	Color	Typical Chromaticity		Typical Luminous Intensity Iv (mcd)	Typical Forward Voltage V_F (V)
		Cx	Cy		
NEW **TLWJ1100**	White	0.32	0.31	750	3.3

2. High-Brightness Compact Surface-Mount LED Lamps — TL**1060 Series

The TL**1060 Series has been developed as a compact version of the TL**1100B Series which is used in automotive instrument panels. This series offers ten different emitted light colors: eight InGaAℓP LED colors: red (2), orange, yellow (2), and green (3); and two InGaN LED colors: emerald green and blue.

Features

- Package size: 2.0 (L) x 1.4 (W) x 1.3 (H) mm
  ⇨ The package size is reduced to less than half the size of that of the TL**1100B Series.
- Lead(Pb)-free reflow soldering



Applications

Backlighting for car interiors and various switches, pilot lamps

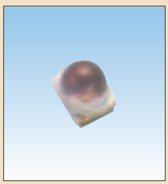
Part Number	Typical Luminous Intensity Iv (mcd) @I_F = 20 mA	Typical Dominant Wavelength d (nm) @I_F = 20 mA	Typical DC Forward Voltage V_F (V) @I_F = 20 mA
NEW **TLRF1060(T18)**	100	630	2.0
NEW **TLSF1060(T18)**	200	613	2.0
NEW **TLOF1060(T18)**	220	605	2.0
NEW **TLYF1060(T18)**	180	587	2.1
NEW **TLPYF1060(T18)**	100	580	2.1
NEW **TLGF1060(T18)**	80	571	2.2
NEW **TLFGF1060(T18)**	50	565	2.2
NEW **TLPGF1060(T18)**	20	558	2.2
NEW **TLEGD1060(T18)**	150	528	3.3
NEW **TLBD1060(T18)**	45	470	3.3

3. High-Brightness Surface-Mount LED Lamps with Lens — TL*H1102B Series

Features

- High-brightness InGaAℓP-LED chip
- Package size:
  3.2 (L) x 2.8 (W) x 3.4 (H) mm
- Colors: Red, Orange, Yellow

Part Number	Typical Luminous Intensity Iv (mcd) @I_F=20 mA	Typical Dominant Wavelength λd (nm) @I_F=20 mA	Typical DC Forward Voltage V_F (V) @I_F=20 mA
NEW **TLRH1102B(T10)**	400	630	1.9
NEW **TLRMH1102B(T10)**	480	626	1.9
NEW **TLSH1102B(T10)**	850	613	1.9
NEW **TLOH1102B(T10)**	950	605	2.0
NEW **TLYH1102B(T10)**	700	587	2.0



4. Blue and Green Surface-Mount LED Lamps—TLBC/TLBD/TLBE/TLEGC/TLEGD/TLEGE/TLGTE Series

Toshiba's LED lamps feature more new color variations to meet our customers' different needs. These series are available in surface-mount packages for use in end products that are small and thin. These LED lamps are used in a variety of applications, such as backlighting for LCDs and switches, compact portable and battery-operated devices.

Features

- Colors: Blue (BC, BD, BE) λ d = 470/472 nm (typ.)
  Green (EGC, EGD, EGE) λ d = 528/535 nm (typ.)
  Bluish green (GTE) λ d = 505nm (typ.)
- Package size: 2.0 (L) x 1.25 (W) x 1.1 (H) mm ⇨ TL✻1002 Series
  3.2 (L) x 2.8 (W) x 1.9 (H) mm ⇨ TL✻1100B Series



Applications

Backlighting for LCDs and switches, indicators for compact portable and battery-operated devices

Absolute Maximum Ratings (Ta = 25˚C)

Part Number	Forward Current I_F (mA)	Reverse Voltage V_R (V)	Allowable Power Dissipation P_D (mW)	Operating Temperature Topr (˚C)	StorageTemperature Tstg (˚C)
TL✻1002 Series	15	4	63	–40 to 85	–40 to 100
TL✻1100B Series	30	4	120 to 135	–40 to 100	–40 to 100

Optical and Electrical Characteristics (Ta = 25˚C)

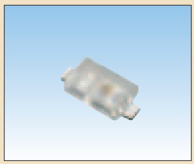
Part Number	Dominant Wavelength λd Typ. (nm)	Luminous Intensity Iv (mcd)		DC Forward Voltage V_F (V)			Reverse Current I_R (μA)	
		Typ.	@I_F (mA)	Typ.	Max	@I_F (mA)	Max	@V_R (V)
NEW **TLBC1002(T02)**	472	45	10	3.0	4.2	10		
NEW **TLBD1100B(T11)**	470	70	20	3.3	4.0	20	10	4
NEW **TLBE1100B(T11)**	470	100	20	3.2	4.3	20		
NEW **TLEGC1002(T02)**	535	120	10	3.0	4.2	10		
NEW **TLEGD1100B(T11)**	528	180	20	3.3	4.0	20	10	4
NEW **TLEGE1100B(T11)**	528	350	20	3.4	4.4	20		
NEW **TLGTE1100B(T11)**	505	300	20	3.3	4.5	20	10	4

5. Small Surface-Mount LED Lamps for Automotive Applications—TL✻H1032 Series

Features

- Thin package :
  1.6 (L) x 0.8 (W) x 0.45 (H) mm
- High-brightness InGaAℓP LED
- Operating temperature: –40˚C to 100˚C
- Lead(Pb)-free reflow soldering
- Colors: Red, Orange, Yellow, Green

Charactaristic	Symbol	Rating	Unit
Forward Current	I_F	25	mA
Reverse Voltage	V_R	4	V
Allowable Power Dissipation	P_D	60/62.5	mW
Operating Temperature	Topr	–40 to 100	˚C
Storage Temparature	Tstg	–40 to 100	˚C



Applications

Backlighting for LCDs and switches for automotive applications.

Part Number	Typical Luminous Intensity I_V (mcd) @I_F = 20 mA	Typical Dominant Wavelength λd (mn) @I_F = 20 mA	Typical DC Forward Voltage V_F (V) @I_F = 20 mA
NEW **TLRH1032(T14,F)/(T15,F)**	56	630	2.0
NEW **TLRMH1032(T14,F)/(T15,F)**	85	626	2.0
NEW **TLSH1032(T14,F)/(T15,F)**	160	613	2.0
NEW **TLOH1032(T14,F)/(T15,F)**	200	605	2.0
NEW **TLYH1032(T14,F)/(T15,F)**	100	587	2.0
NEW **TLGH1032(T14,F)/(T15,F)**	60	571	2.1
NEW **TLFGH1032(T14,F)/(T15,F)**	25	565	2.2

2. Overview

1. Features

Toshiba offers various products featuring high brightness, multiple colors and a wide variety of package types.
Please select the appropriate product for your application.

Through-Hole Type

- Total 10 colors: 4 red, 1 orange, 2 yellow, 3 green
- Four-element (InGaAℓP) LEDs are available for outdoor applications
- Various package allows customers to select the LED whose viewing angle best meets the requirements for their applications.

SMD Type

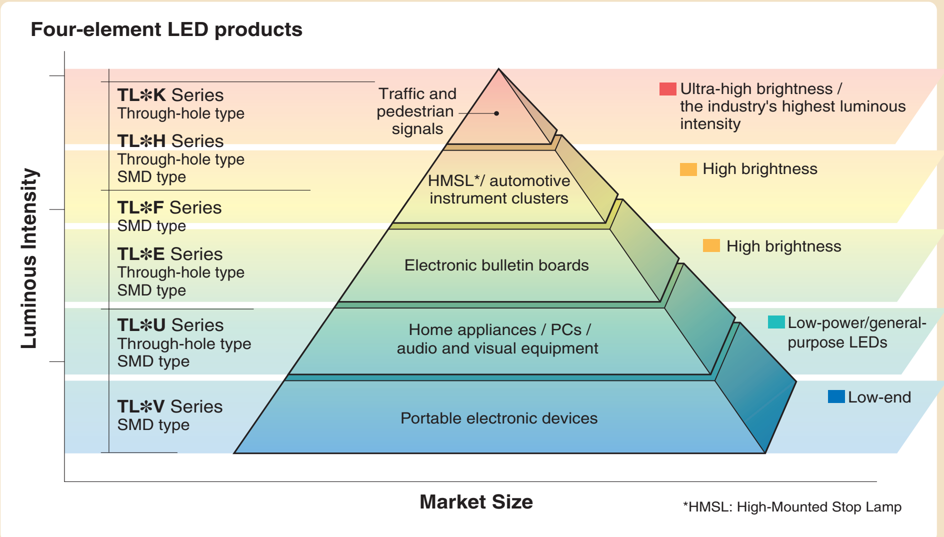
- Wide range of packages for cellular phones and automotive applications
- Variety of colors: White, Blue, Bluish green, Reddish purple
- Reflow soldering
- Toshiba original ø2-mm lens-type LEDs are now available and meet the demand for low-profile end products. Conventional through-hole LEDs were not able to meet this demand.

2. Advantages of Four-Element High-Brightness LED Lamps

What is a Four-Element LED?

A four-element LED is a compound semiconductor made up of four elements: In, Ga, Aℓ, and P. With this structure, the same material and the same crystal growth method can be used to generate high-brightness lights in all colors from green to red.

Large Market Size of Four-Element LEDs

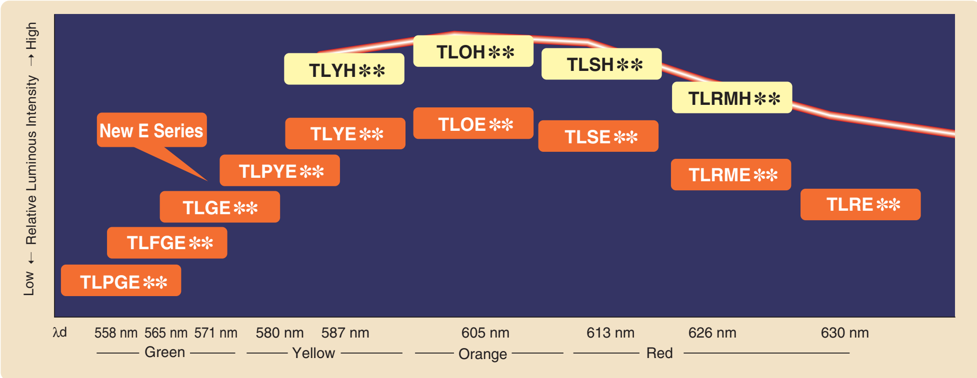


Advantages of High-Brightness LEDs

- Excellent visibility: Usable in daylight and indoor applications. Operating status can be read even from a distance.
- Low power consumption: Power consumption is less than that of standard LEDs since high brightness is achieved at low current.
- Low component count: The number of LEDs used for LCD backlighting can be reduced. Component assembly cost can be also saved.
- High reliability: Longer operating life can be achieved at low forward current.

3. Colors of Four-Element High-Brightness LED Lamps

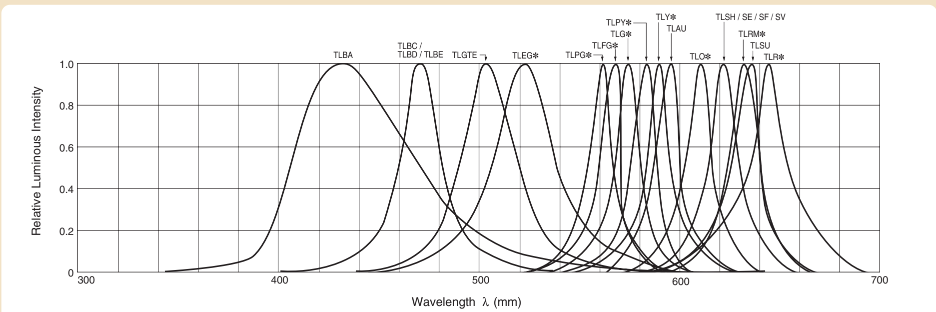
Below is an overview of Toshiba's high-brightness LEDs, showing the H and E Series.



4. Colors and Materials

Color	Material	Peak Emission Wavelength (typ.) λp (nm) @IF = 20 mA	Dominannt λd (nm) @IF = 20 mA	Color Symbol
Red	InGaAℓP	644	630	RH/RE/RF/RU
	InGaAℓP	636	626	RMK/RMH/RME/RMV
	InGaAℓP	636	623	SU
	InGaAℓP	623	613	SH/SE/SF/SV
Orange	InGaAℓP	612	605	OH/OE/OF/OV/OU
Amber	InGaAℓP	596	592	AU
Yellow	InGaAℓP	590	587	YK/YH/YE/YF/YV/YU
	InGaAℓP	583	580	PYE/PYF
Green	InGaAℓP	574	571	GE/GF/GV/GU
	InGaAℓP	568	565	FGE/FGF
	InGaAℓP	562	558	PGE/PGF/PGV/PGU
	InGaN	523	528	EGC/EGD/EGE
	InGaN	496	505	GTE
Blue	InGaN	468	470	BC/BD/BE
	GaN	428	465	BA

Typical Spectrum of Main Products



Note: For details, refer to the relevant technical datasheets.

6. Luminous Intensity Classification

Through-Hole Type / SMD Type

Bin	Luminous Intensity (mcd)	Bin	Luminous Intensity (mcd)
A	0.09 to 0.23	N	85 to 230
B	0.15 to 0.41	P	153 to 414
C	0.27 to 0.74	Q	272 to 736
D	0.48 to 1.29	R	476 to 1,290
E	0.85 to 2.3	S	850 to 2,300
F	1.53 to 4.14	T	1,530 to 4,140
G	2.72 to 7.36	U	2,720 to 7,360
H	4.76 to 12.9	V	4,760 to 12,900
J	8.5 to 23	W	8,500 to 23,000
K	15.3 to 41.4	X	15,300 to 41,400
L	27.2 to 73.6	Y	27,200 to 73,600
M	47.6 to 129		

TL✻✻1100B / 1106 / 1060 / 1102B Series

Bin		Luminous Intensity (mcd)	Bin		Luminous Intensity (mcd)
JA	JA1	4.0 to 6.3	RA	RA1	100 to 160
	JA2	5.0 to 8.0		RA2	125 to 200
KA	KA1	6.3 to 10	SA	SA1	160 to 250
	KA2	8.0 to 12.5		SA2	200 to 320
LA	LA1	10 to 16	TA	TA1	250 to 400
	LA2	12.5 to 20		TA2	320 to 500
MA	MA1	16 to 25	UA	UA1	400 to 630
	MA2	20 to 32		UA2	500 to 800
NA	NA1	25 to 40	VA	VA1	630 to 1000
	NA2	32 to 50		VA2	800 to 1250
PA	PA1	40 to 63	WA	WA1	1000 to 1600
	PA2	50 to 80		WA2	1250 to 2000
QA	QA1	63 to 100			
	QA2	80 to 125			

Part Number Format for Through-Hole Type

Example: TLYH16TP (ST, F)

- TLYH16TP: Part number
- ST: Luminous intensity bin
- F: Lead-free lead finish

The example shows the case of the TLYH16TP, which includes bins S and T. Binned products are normally two bins (standard).

· For the available luminous intensity bin, contact your nearest Toshiba representatives.

7. Lens Color and Appearance

Lens Color	Transparent	Colorless diffused	Colored transparent	Colored diffused
Appearance				

A colored transparent lens and colored deffused lens are of the same color as the emitted light.

7. Pulse Operation

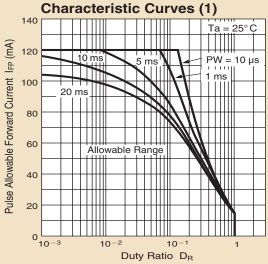
Refer to the graphs for pulse allowable forward current ratings below. Note that pulse operation requires derating with respect to the ambient temperature, as does DC operation.

Pulse allowable forward current rating (T_a = 25° C)

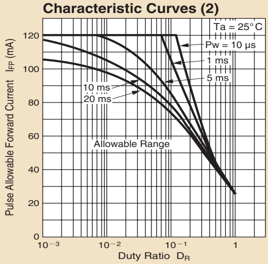
DC Forward Current I_F max (mA)	Pulse Allowable Forward Current I_{FP} max (Note 1) (mA)	Characteristic Curves
15	120	1
25		2
30		3
50	200	4
70		5

Note 1:
Pulse width Pw = 100 μs,
Duty ratio $D_R = 10^{-1}$

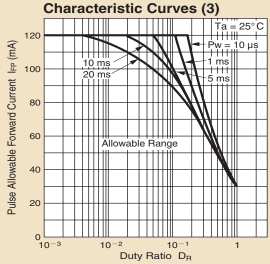
Characteristic Curves (1)



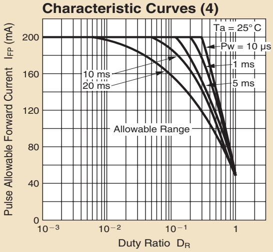
Characteristic Curves (2)



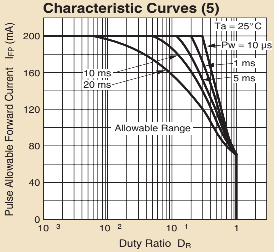
Characteristic Curves (3)



Characteristic Curves (4)



Characteristic Curves (5)



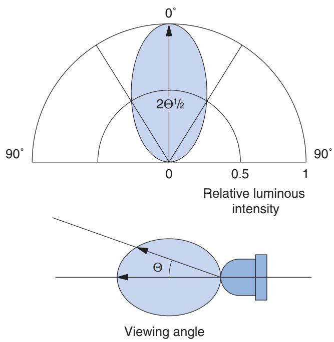
8. Main Characteristics

Absolute Maximum Ratings

The absolute maximum ratings of a semiconductor device are a set of specified parameter values that must not be exceeded during operation, even for an instant. Circuit designers need to be fully aware of the importance of absolute maximum ratings.

Viewing Angle

This parameter indicates the ratio of the LED's luminous intensity to its axial luminous intensity (= 100%) as viewed from an angle of Θ with respect to the axis of the light source. The angle at which luminous intensity is exactly 50% of the axial luminous intensity is called the half-value angle Θ 1/2. The half-value angle on both sides of the axis is expressed as 2 Θ 1/2.



Luminous Intensity

Luminous intensity is equal to the amount of luminous flux emitted into a solid angle at a defined angular orientation from the light source. The measurement unit for luminous intensity is mcd. A narrow viewing angle LED provides a high luminous intensity.

Temperature Dependence

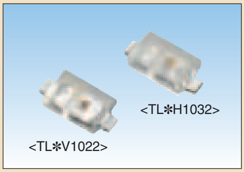
The light output changes according to the ambient temperature.

3. Product List for the SMD Type

1. TL✻V1022(T14,F), TL✻V1022(T15,F), TL✻H1032(T14,F), TL✻H1032(T15,F)

Features

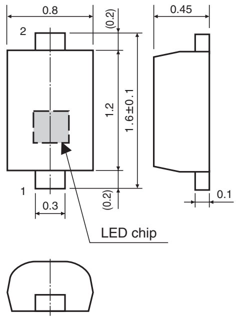
- Package dimensions: 1.6 (L) x 0.8 (W) x 0.45 (H) mm (including lead length)
- New LED chip structure achieving high-brightness and low-current drive (TL✻V1022)
- The TL✻V1022 Series can replace the previous high-brightness LED lamps.
- TL✻H1032 Series can be used in automotive interior applications.
- Lead(Pb)-Free reflow soldering



Package Dimensions

(Unit: mm)

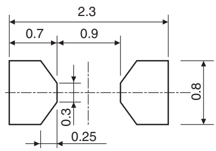
TL✻V1022 Series/TL✻H1032 Series



1. Cathode
2. Anode
Tolerance: ±0.05

Recommended Soldering Pad Dimensions

(Unit: mm)



Absolute Maximum Ratings

Ta = 25°C

Characteristic	Symbol	Rating	Unit
Forward Current	I_F	15/25	mA
Reverse Voltage	V_R	4	V
Power Dissipation	P_D	34.5 to 62.5	mW
Operating Temperature	Topr	–40 to 100	°C
Storage Temperature	Tstg	–40 to 100	°C

Note: Refer to the relevant technical datasheet for the detail.

Electrical and Optical Characteristics

@Ta = 25°C

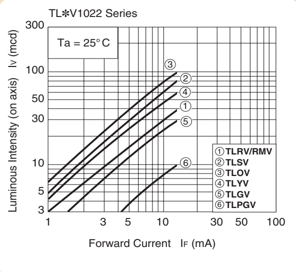
Series Name	Part Number	Color	Dominant Wavelength λd Typ. (nm) @IF = 5 mA	DC Forward Voltage VF (V) @IF = 5 mA		Reverse Current IR (μA) @VR = 4 V	Luminous Intensity IV (mcd) @IF = 5 mA		Available Bins
				Typ.	Max	Max	Min	Typ.	
TL✻V Series (InGaAℓP)	☆ TLRV1022(T14,F)/(T15,F)	Red	630	1.8	2.1	10	4.76	15	# JK
	☆ TLRMV1022(T14,F)/(T15,F)	Red	626	1.8	2.1	10	4.76	15	# JK
	☆ TLSV1022(T14,F)/(T15,F)	Red	613	2.0	2.3	10	8.5	30	# KL
	☆ TLOV1022(T14,F)/(T15,F)	Orange	605	2.0	2.3	10	8.5	38	# KL
	☆ TLYV1022(T14,F)/(T15,F)	Yellow	587	2.0	2.3	10	8.5	25	# KL
	☆ TLGV1022(T14,F)/(T15,F)	Green	571	2.0	2.3	10	4.76	14	# JK
	☆ TLPGV1022(T14,F)/(T15,F)	Pure green	558	2.0	2.3	10	1.53	3.5	# FG

Series Name	Part Number	Color	Dominant Wavelength λd Typ. (nm) @IF = 20 mA	DC Forward Voltage VF (V) @IF = 20 mA		Reverse Current IR (μA) @VR = 4 V	Luminous Intensity IV (mcd) @IF = 20 mA		Available Bins
				Typ.	Max	Max	Min	Typ.	
TL✻H Series (InGaAℓP)	NEW ☆ TLRH1032(T14,F)/(T15,F)	Red	630	2.0	2.4	10	25	56	-
	NEW ☆ TLRMH1032(T14,F)/(T15,F)	Red	626	2.0	2.4	10	40	85	-
	NEW ☆ TLSH1032(T14,F)/(T15,F)	Red	613	2.0	2.4	10	63	160	-
	NEW ☆ TLOH1032(T14,F)/(T15,F)	Orange	605	2.0	2.4	10	100	200	-
	NEW ☆ TLYH1032(T14,F)/(T15,F)	Yellow	587	2.0	2.4	10	40	100	-
	NEW ☆ TLGH1032(T14,F)/(T15,F)	Green	571	2.1	2.5	10	25	60	-
	NEW ☆ TLFGH1032(T14,F)/(T15,F)	Fresh green	565	2.2	2.5	10	10	25	-

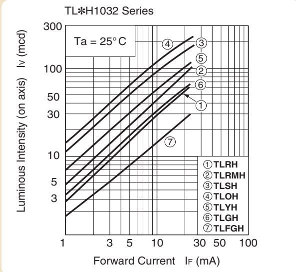
☆: Sealed in a moisture-proof bag
: For the available luminous intensity bins and further details, contact your nearest Toshiba sales representative.

Typical Characteristics

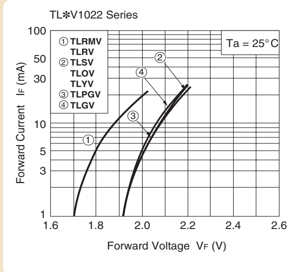
Iv — If ①



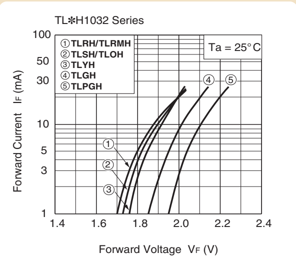
Iv — If ②



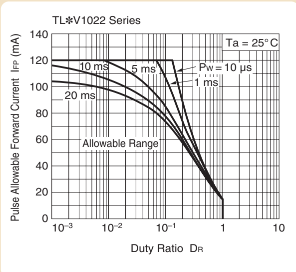
If — Vf ①



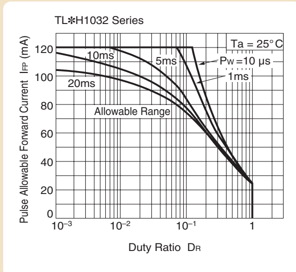
If — Vf ②



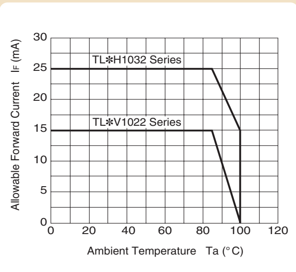
Pulse allowable forward current characteristics



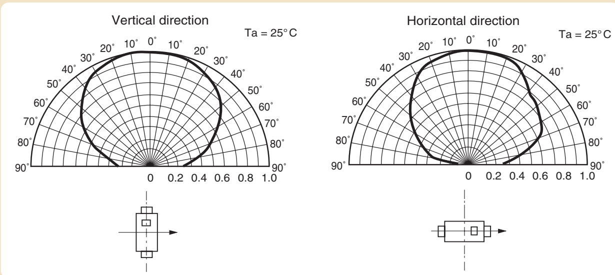
Pulse allowable forward current characteristics



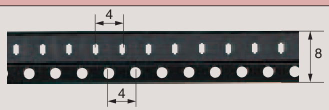
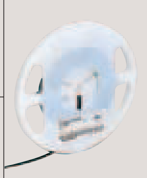
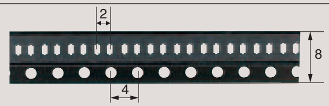
If — Ta



Radiation pattern



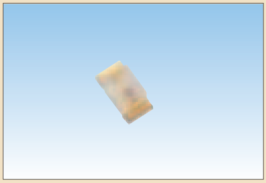
Tape and Reel Specifications

Tape Type	Suffix to Part Number	Pitch	Packing Container		Quantity / Reel
			Tape dimensions (mm)	Appearance	
Embossed tape	T14	4 mm			4000 pcs / reel
Embossed tape	T15	2 mm			8000 pcs / reel

2. TL✻E1008A(T04), TL✻E1008A(T05), TL✻U1008A(T04), TL✻U1008A(T05)

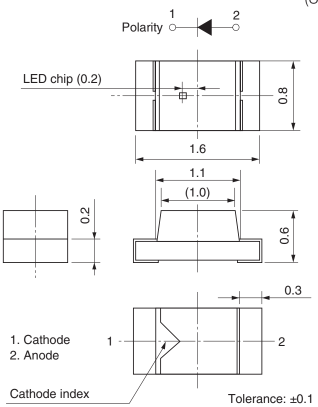
Features

- Package dimensions: 1.6 (L) x 0.8 (W) x 0.6 (H) mm
- High brightness and low power consumption
- Available in T04 tape (4 mm pitch) and T05 tape (2 mm pitch).
  Use of T05 tape improves the efficiency of assembly process.
- Low-profile package (t = 0.6 mm) suitable for use as backlighting in thin equipment.
- Lead(Pb)-Free reflow soldering



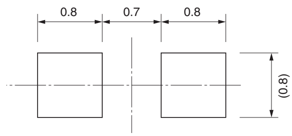
Package Dimensions

(Unit: mm)



Recommended Soldering Patterns

(Unit: mm)



Absolute Maximum Ratings

Ta = 25°C

Characteristic	Symbol	Rating	Unit
Forward Current	I_F	25	mA
Reverse Voltage	V_R	4	V
Power Dissipation	P_D	60 to 62.5 (Note 1)	mW
Operating Temperature	Topr	−40 to 85	°C
Storage Temperature	Tstg	−40 to 100	°C

Note 1: Refer to the relevant technical datasheet.

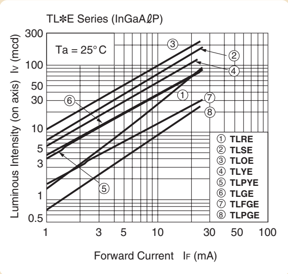
Electrical and Optical Characteristics

Series Name	Color	Part Number	Typical Luminous Intensity Iv (mcd) @IF = 20 mA		Forward Voltage VF (V) @IF = 20 mA		Reverse Current IR (μA) @VR = 4 V	Typical Emission Wavelength (nm) @IF = 20 mA			Available Bins
			Min	Typ.	Typ.	Max	Max	λp	Δλ	λd	
TL✻E Series (InGaAℓP)	Red	☆ **TLRE1008A(T04)/(T05)**	27.2	70	1.9	2.4	50	644	18	630	# LM
	Red	☆ **TLSE1008A(T04)/(T05)**	47.6	140	1.9	2.4	50	623	17	613	# MN
	Orange	☆ **TLOE1008A(T04)/(T05)**	47.6	180	2.0	2.4	50	612	15	605	# MN
	Yellow	☆ **TLYE1008A(T04)/(T05)**	27.2	105	2.0	2.4	50	590	13	587	# MN
	Pure yellow	☆ **TLPYE1008A(T04)/(T05)**	27.2	70	2.0	2.4	50	583	13	580	# LM
	Green	☆ **TLGE1008A(T04)/(T05)**	27.2	70	2.0	2.4	50	574	11	571	# LM
	Green	☆ **TLFGE1008A(T04)/(T05)**	8.5	25	2.0	2.4	50	568	11	565	# JK
	Pure green	☆ **TLPGE1008A(T04)/(T05)**	4.76	18	2.1	2.4	50	562	11	558	# HJ
TL✻U Series (InGaAℓP)	Red	☆ **TLSU1008A(T04)/(T05)**	27.2	60	2.0	2.4	50	636	17	623	# LM
	Orange	☆ **TLOU1008A(T04)/(T05)**	27.2	78	2.1	2.5	50	612	15	605	# MN
	Amber	☆ **TLAU1008A(T04)/(T05)**	8.5	30	2.1	2.5	50	596	13	592	# LM
	Yellow	☆ **TLYU1008A(T04)/(T05)**	8.5	30	2.1	2.5	50	590	13	587	# LM
	Green	☆ **TLGU1008A(T04)/(T05)**	8.5	30	2.1	2.5	50	574	11	571	# KL
	Pure green	☆ **TLPGU1008A(T04)/(T05)**	1.53	6	2.1	2.5	50	562	11	558	# GH

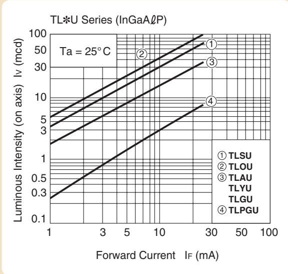
☆: Sealed in a moisture-proof bag.
#: For the available luminous intensity bins and further details, contact your nearest Toshiba sales representative.

Typical Characteristics

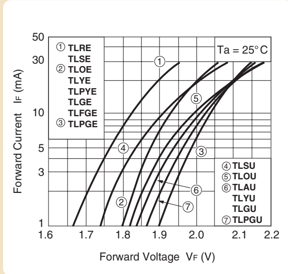
Iv – IF



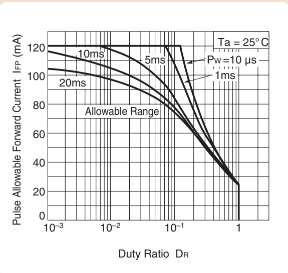
Iv – IF



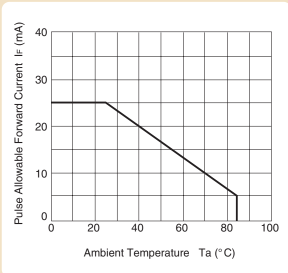
Iv – VF



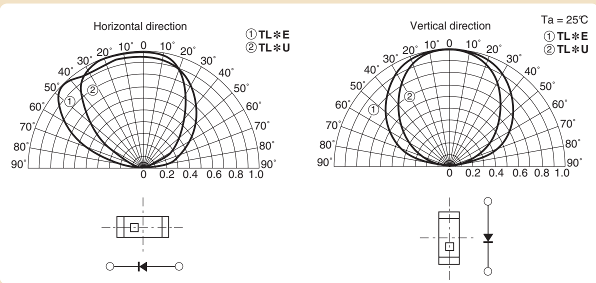
Pulse allowable forward current characteristics



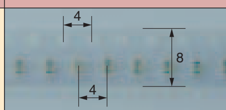
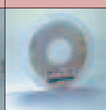
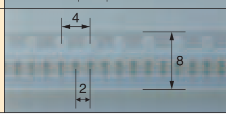
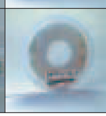
Iv – TF



Radiation pattern



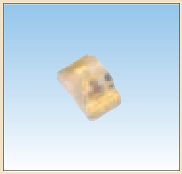
Tape and Reel Specifications

Tape Type	Suffix to Part Number	Pitch	Packing Container		Quantity / Reel
			Tape dimensions (mm)	Appearance	
Embossed tape	T04	4 mm			4000 pcs / reel
Embossed tape	T05	2 mm			8000 pcs / reel

3. TL✻E1002A(T02), TL✻U1002A(T02), TL✻C1002(T02)

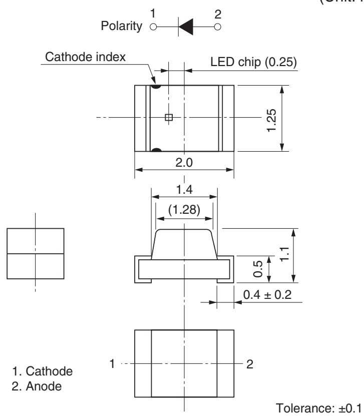
Features

- Package dimensions: 2.0 (L) x 1.25 (W) x 1.1 (H) mm
- Four-element (InGaAℓP) and InGaN high-brightness LED
- Replacement of the general-purpose luminosity LED lamps contributes to reducing power consumption and obtaining higher brightness in end products.
- A package height of 1.1 mm supports use in slim-profile devices as backlighting.
- Lead(Pb)-Free reflow soldering



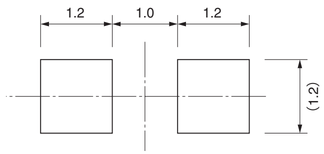
Package Dimensions

(Unit: mm)



Recommended Soldering Patterns

(Unit: mm)



Absolute Maximum Ratings

Ta = 25°C

Characteristic	Symbol	Rating	Unit
Forward Current	I_F	15/25 (Note 1)	mA
Reverse Voltage	V_R	4	V
Power Dissipation	P_D	60 to 63 (Note 1)	mW
Operating Temperature	Topr	–40 to 85	°C
Storage Temperature	Tstg	–40 to 100	°C

Note 1: Refer to the relevant technical datasheet.

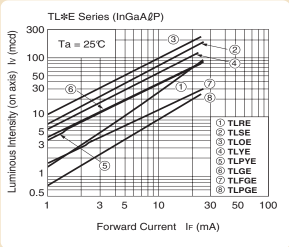
Electrical and Optical Characteristics

Series Name	Color	Part Number	Typical Luminous Intensity Iv (mcd) @IF = 20 mA		Forward Voltage VF (V) @IF = 20 mA		Reverse Current IR (μA) @VR = 4 V	Typical Emission Wavelength (nm) @IF = 20 mA			Available Bins
			Min	Typ.	Typ.	Max	Max	λp	Δλ	λd	
TL✻E Series (InGaAℓP)	Red	☆ **TLRE1002A(T02)**	27.2	70	1.9	2.4	50	644	18	630	# LM
	Red	☆ **TLSE1002A(T02)**	47.6	140	1.9	2.4	50	623	17	613	# MN
	Orange	☆ **TLOE1002A(T02)**	47.6	180	2.0	2.4	50	612	15	605	# MN
	Yellow	☆ **TLYE1002A(T02)**	27.2	105	2.0	2.4	50	590	13	587	# MN
	Pure yellow	☆ **TLPYE1002A(T02)**	27.2	70	2.0	2.4	50	583	13	580	# LM
	Green	☆ **TLGE1002A(T02)**	27.2	70	2.0	2.4	50	574	11	571	# LM
	Green	☆ **TLFGE1002A(T02)**	8.5	25	2.0	2.4	50	568	11	565	# JK
	Pure green	☆ **TLPGE1002A(T02)**	4.76	18	2.0	2.4	50	562	11	558	# HJ
TL✻U Series (InGaAℓP)	Red	☆ **TLRU1002A(T02)**	4.76	45	2.0	2.4	50	644	18	630	# KL
	Red	☆ **TLSU1002A(T02)**	27.2	60	2.0	2.4	50	636	17	623	# LM
	Orange	☆ **TLOU1002A(T02)**	27.2	78	2.1	2.5	50	612	15	605	# MN
	Amber	☆ **TLAU1002A(T02)**	8.5	30	2.1	2.5	50	596	13	592	# LM
	Yellow	☆ **TLYU1002A(T02)**	8.5	30	2.1	2.5	50	590	13	587	# LM
	Green	☆ **TLGU1002A(T02)**	8.5	30	2.1	2.5	50	574	11	571	# KL
	Pure green	☆ **TLPGU1002A(T02)**	1.53	6	2.1	2.5	50	562	11	558	# GH
TL✻C Series (InGaN)	Green	☆ **TLEGC1002(T02)**	✻40	✻120	✻3.0	✻4.2	10	✻520	✻35	✻535	—
	Blue	☆ **TLBC1002(T02)**	✻16	✻45	✻3.0	✻4.2	10	✻470	✻25	✻472	—

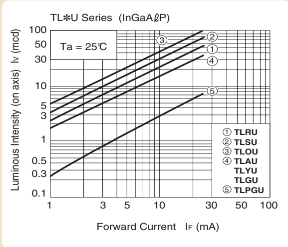
☆: Sealed in a moisture-proof bag. ✻: IF = 10 mA
#: For the available luminous intensity bins and further details, contact your nearest Toshiba sales representative.

Typical Characteristics

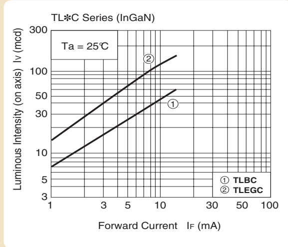
Iv — IF



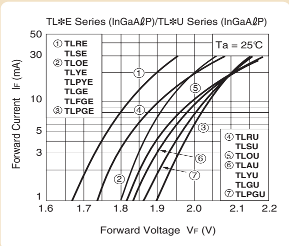
Iv — IF



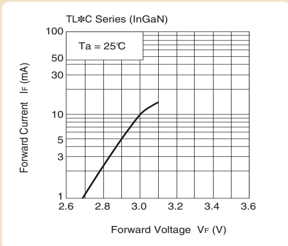
Iv — IF



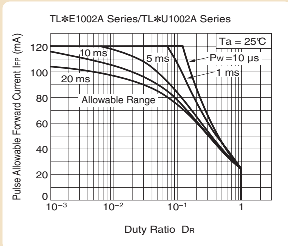
IF — VF



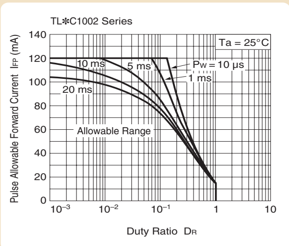
IF — VF



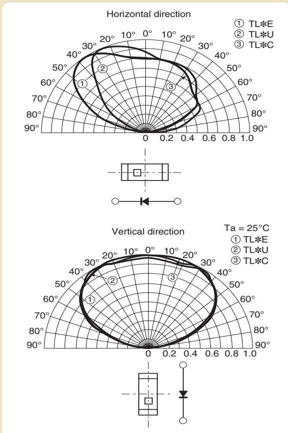
Pulse allowable forward current characteristics



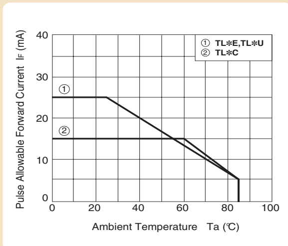
Pulse allowable forward current characteristics



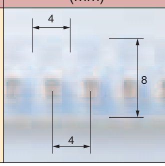
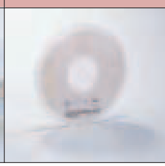
Radiation pattern



IF — Ta



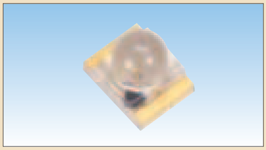
Tape and Reel Specifications

Tape Type	Suffix to Part Number	Pitch	Packing Container		Quantity / Reel
			Tape dimensions (mm)	Appearance	
Embossed tape	T02	4mm			3000 pcs / reel

4. TL✻E1005B(T03)

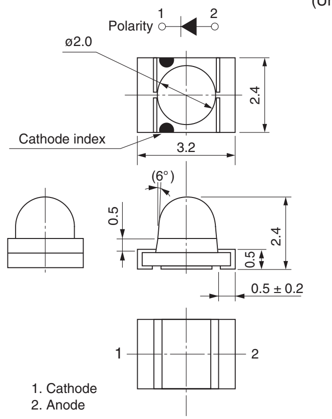
Features

- Package dimensions: 3.2 (L) x 2.4 (W) x 2.4 (H) mm
- Four-element (InGaAℓP) high-brightness LED
- Package with ø2 mm lens substantially improves light extraction.
- Designed for miniaturization and slimming while maintaining high-brightness emission.
- Optical axis precision is substantially improved compared with the through-hole type. Designed to reduce nonuniformity in display contrast.



Package Dimensions

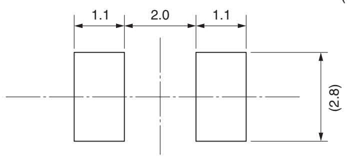
(Unit: mm)



Tolerance: ±0.1

Recommended Soldering Patterns

(Unit: mm)



Absolute Maximum Ratings

Ta = 25°C

Characteristic	Symbol	Rating	Unit
Forward Current	I_F	25	mA
Reverse Voltage	V_R	4	V
Power Dissipation	P_D	60	mW
Operating Temperature	Topr	−40 to 85	°C
Storage Temperature	Tstg	−40 to 100	°C

Electrical and Optical Characteristics

Series Name	Color	Part Number	Typical Luminous Intensity Iv (mcd) @IF = 20 mA		Forward Voltage VF (V) @IF = 20 mA		Reverse Current IR (μA) @VR = 4 V	Typical Emission Wavelength (nm) @IF = 20 mA			Available Bins
			Min	Typ.	Typ.	Max	Max	λp	Δλ	λd	
TL✻E Series (InGaAℓP)	Red	☆ TLRE1005B(T03)	153	450	1.9	2.4	50	644	18	630	# PQ
	Red	☆ TLSE1005B(T03)	272	1000	1.9	2.4	50	623	17	613	# RS
	Orange	☆ TLOE1005B(T03)	476	1500	2.0	2.4	50	612	15	605	# RS
	Yellow	☆ TLYE1005B(T03)	272	850	2.0	2.4	50	590	13	587	# RS
	Pure yellow	☆ TLPYE1005B(T03)	153	430	2.0	2.4	50	583	13	580	# QR
	Green	☆ TLGE1005B(T03)	153	350	2.0	2.4	50	574	11	571	# PQ
	Green	☆ TLFGE1005B(T03)	85	260	2.0	2.4	50	568	11	565	# PQ
	Pure green	☆ TLPGE1005B(T03)	47.6	130	2.1	2.4	50	562	11	558	# MN

☆: Sealed in a moisture-proof bag.
#: For the available luminous intensity bins and further details, contact your nearest Toshiba sales representative.

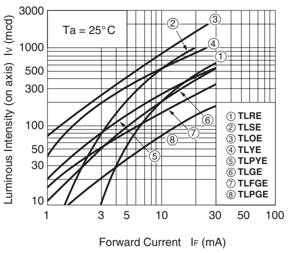
Recommended Conditions for Automated Pick-and-Place Assembly

Diameter of vacuum head	ø1.2 mm

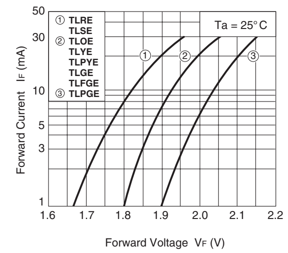
For other relevant information, consult the manufacturer of the automated pick-and-place equipment.

Typical Characteristics

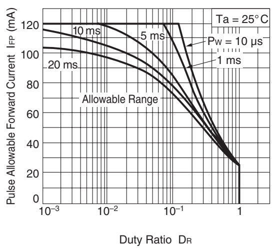
Iv – If



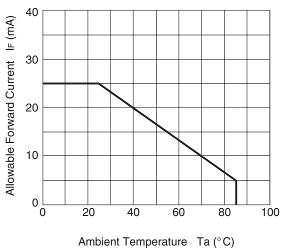
IF – VF



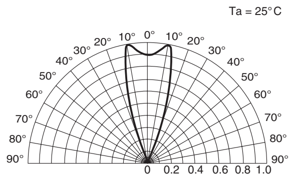
Pulse allowable forward current characteristics



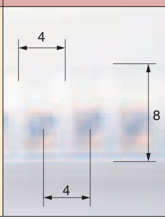
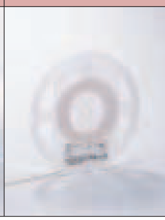
IF – Ta



Radiation pattern



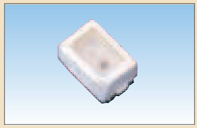
Tape and Reel Specifications

Tape Type	Suffix to Part Number	Pitch	Packing Container		Quantity / Reel
			Tape dimensions (mm)	Appearance	
Embossed tape	T03	4mm			1000 pcs / reel

5. TL✻F1060(T18), TL✻D1060(T18)

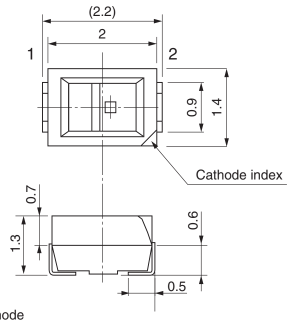
Features

- Package dimensions: 2.2 (L) x 1.4 (W) x 1.3 (H) mm
- Resin with high heat resistance used for the package extends the range of the operating temperature.
  Topr = –40 to 100°C
- Lead(Pb)-Free reflow soldering



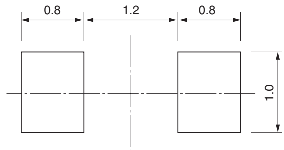
Package Dimensions

(Unit: mm)



Recommended Soldering Patterns

(Unit: mm)



Absolute Maximum Ratings

Ta = 25℃

Characteristic	Symbol	Rating	Unit
Forward Current (DC)	I_F	30	mA
Reverse Voltage	V_R	4 to 15	V
Power Dissipation	P_D	75 to 120 (Note 1)	mW
Operating Temperature	Topr	–40 to 100	°C
Storage Temperature	Tstg	–40 to 100	°C

Note 1: Refer to the relevant technical datasheet.

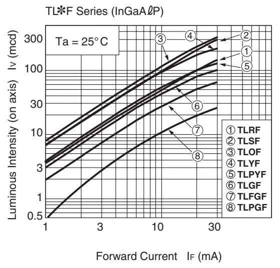
Electrical and Optical Characteristics

Series Name	Color	Part Number	Typical Luminous Intensity Iv (mcd) @IF = 20 mA		Forward Voltage VF (V) @IF = 20 mA		Reverse Current IR (μA) @VR = 4 V	Typical Emission Wavelength (nm) @IF = 20 mA		
			Min	Typ.	Typ.	Max	Max	λp	Δλ	λd
TL✻F Series (InGaAℓP)	Red	NEW ☆ **TLRF1060(T18)**	40	100	2.0	2.5	10	644	18	630
	Red	NEW ☆ **TLSF1060(T18)**	100	200	2.0	2.5	10	623	17	613
	Orange	NEW ☆ **TLOF1060(T18)**	100	220	2.0	2.5	10	612	15	605
	Yellow	NEW ☆ **TLYF1060(T18)**	63	140	2.1	2.5	10	590	13	587
	Pure yellow	NEW ☆ **TLPYF1060(T18)**	40	100	2.1	2.5	10	583	13	580
	Green	NEW ☆ **TLGF1060(T18)**	40	80	2.1	2.5	10	574	11	571
	Green	NEW ☆ **TLFGF1060(T18)**	25	50	2.1	2.5	10	568	11	565
	Pure green	NEW ☆ **TLPGF1060(T18)**	10	20	2.1	2.5	10	562	11	558
TL✻D Series (InGaN)	Blue	NEW ☆ **TLBD1060(T18)**	25	60	3.3	4.0	✻10	468	25	470
	Green	NEW ☆ **TLEGD1060(T18)**	63	150	3.3	4.0	✻10	523	35	528

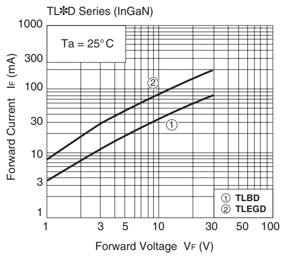
☆: Sealed in a moisture-proof bag. ✻: V_R = 4 V

Typical Characteristics

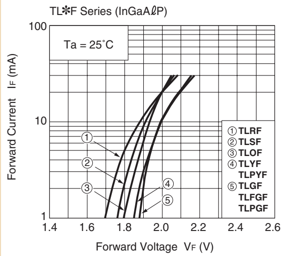
Iv — IF



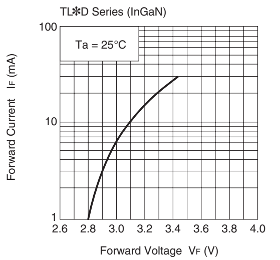
Iv — IF



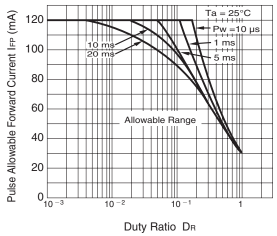
IF — VF



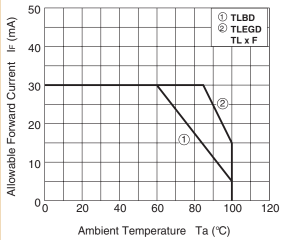
Iv — IF

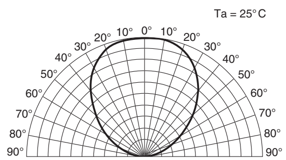


Pulse allowable forward current characteristics

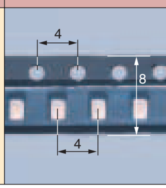
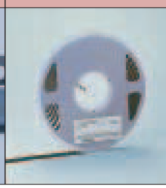


IF — Ta





Tape and Reel Specifications

Tape Type	Suffix to Part Number	Pitch	Packing Container		Quantity / Reel
			Tape dimensions (mm)	Appearance	
Embossed tape	T18	4 mm			3000 pcs / reel

3. Product List for the SMD Type

6. TL✻✻1100B Series

▶ InGaAℓP Series

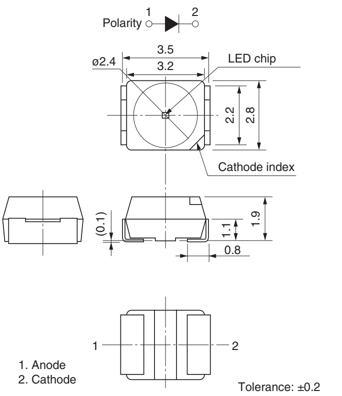
Features

- Package dimensions: 3.2 (L) x 2.8 (W) x 1.9 (H) mm
- Resin with high heat resistance is adopted for the package; the device can be used in high temperature.
  Wide operating temperature range:
  Topr = –40 to 100 °C: TL✻E Series
  Topr = –40 to 110 °C: TL✻H Series
- Lead(Pb)-Free reflow soldering



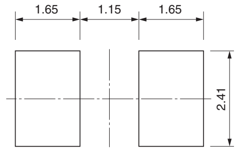
Package Dimensions

(Unit: mm)



Recommended Soldering Patterns

(Unit: mm)



Absolute Maximum Ratings

Ta = 25℃

Characteristic	Symbol	Rating	Unit
Forward Current (DC)	IF	50/70 (Note 1)	mA
Reverse Voltage	VR	4	V
Power Dissipation	PD	120 to 161 (Note 1)	mW
Operating Temperature	Topr	(Note 1) –40 to 100/–40 to 110	°C
Storage Temperature	Tstg		

Note 1: Refer to the relevant technical datasheet.

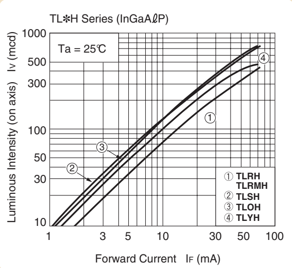
Electrical and Optical Characteristics

Series Name	Color	Part Number	Typical Luminous Intensity Iv (mcd) @IF = 20 mA		Forward Voltage VF (V) @IF = 20 mA		Reverse Current IR (μA) @VR = 4 V	Typical Emission Wavelength (nm) @IF = 20 mA		
			Min	Typ.	Typ.	Max	Max	λp	Δλ	λd
TL✻H Series (InGaAℓP)	Red	☆ **TLRH1100B(T11)**	63	150	1.9	2.3	10	644	18	630
	Red	☆ **TLRMH1100B(T11)**	63	150	1.9	2.3	10	636	17	626
	Red	☆ **TLSH1100B(T11)**	160	260	1.9	2.3	10	623	17	613
	Orange	☆ **TLOH1100B(T11)**	160	270	2.0	2.3	10	612	15	605
	Yellow	☆ **TLYH1100B(T11)**	100	220	2.0	2.3	10	590	15	587
TL✻E Series (InGaAℓP)	Red	☆ **TLRE1100B(T11)**	40	100	1.9	2.4	50	644	18	630
	Red	☆ **TLSE1100B(T11)**	63	180	1.9	2.4	50	623	15	613
	Orange	☆ **TLOE1100B(T11)**	63	150	2.0	2.4	50	612	15	605
	Yellow	☆ **TLYE1100B(T11)**	63	150	2.0	2.4	50	590	13	587
	Green	☆ **TLGE1100B(T11)**	40	100	2.0	2.4	50	574	11	571
	Green	☆ **TLFGE1100B(T11)**	25	45	2.0	2.4	50	568	11	565
	Pure green	☆ **TLPGE1100B(T11)**	10	25	2.1	2.4	50	562	11	558

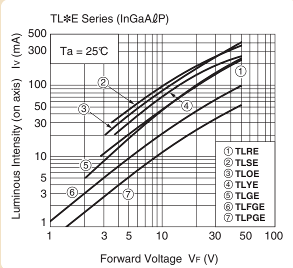
☆: Sealed in a moisture-proof bag.

Typical Characteristics

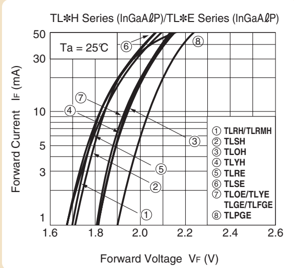
Iv – If



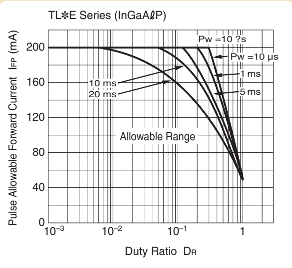
Iv – If



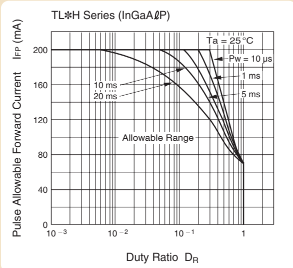
If – Vf



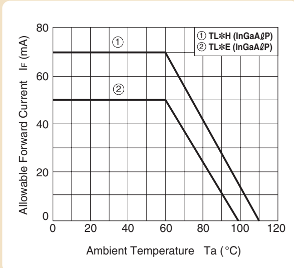
Pulse allowable forward current characteristics



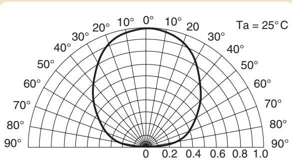
Pulse allowable forward current characteristics



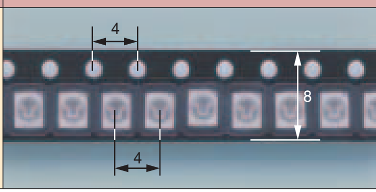
If – Ta



Radiation pattern



Tape and Reel Specifications

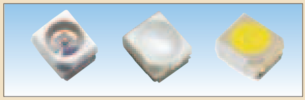
Tape Type	Suffix to Part Number	Pitch	Packing Container		Quantity / Reel
			Tape dimensions (mm)	Appearance	
Embossed tape	T11	4 mm			2000 pcs / reel

3. Product List for the SMD Type

▶ InGaN and GaN Series

Features

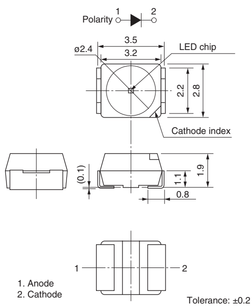
- Package dimensions: 3.2 (L) x 2.8 (W) x 1.9 (H) mm
- Resin with high heat resistance is adopted for the package; the device can be used in high temperature.
  Wide operating temperature range:
  Topr = –40 to 100°C
- Lead(Pb)-Free reflow soldering : TL✻✻1100B Series
- Reflow soldering : TL✻✻1100 Series



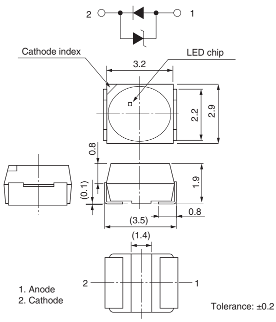
Package Dimensions

(Unit: mm)

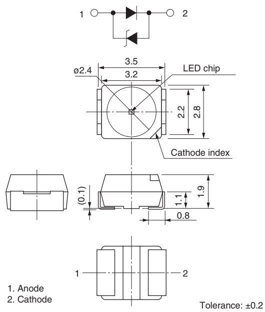
TL✻E Series/TL✻D Series/TLBA1100B



TLWA1100/TLBGA1100/TLRPA1100

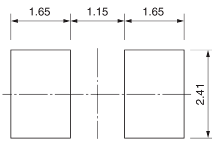


TLWH1100/TLWJ1100



Recommended Soldering Patterns

(Unit: mm)



Absolute Maximum Ratings

Ta = 25℃

Characteristic	Symbol	Rating	Unit
Forward Current (DC)	I_F	30 (Note 1)	mA
Reverse Voltage	V_R	4	V
Power Dissipation	P_D	120 to 135 (Note 1)	mW
Operating Temperature	Topr	−40 to 100 (Note 1)	°C
Storage Temperature	Tstg		

Note 1: Refer to the relevant technical datasheet.

Electrical and Optical Characteristics

Series Name	Color	Part Number	Typical Luminous Intensity Iv (mcd) @I_F = 20 mA Min	Typ.	Forward Voltage V_F (V) @I_F = 20 mA Typ.	Max	Reverse Current I_R (μA) @V_R = 4 V Max	Typical Emission Wavelength (nm) @I_F = 20 mA λp	Δλ	λd
TL✻E Series (InGaN)	Green	☆ TLEGE1100B(T11)	100	350	3.4	4.4	10	523	35	528
	Bluish green	☆ TLGTE1100B(T11)	160	300	3.3	4.5	10	496	30	505
	Blue	☆ TLBE1100B(T11)	63	100	3.2	4.3	10	468	25	470
TL✻D Series (InGaN)	Green	NEW ☆ TLEGD1100B(T11)	100	200	3.3	4.0	10	523	35	528
	Blue	NEW ☆ TLBD1100B(T11)	40	70	3.3	4.0	10	468	25	470
TL✻A Series (GaN)	Blue	☆ TLBA1100B(T11)	※4	※7	※3.7	※4.2	10	※428	※60	※465

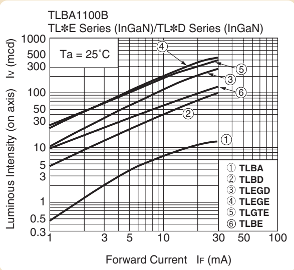
☆: Sealed in a moisture-proof bag. ※: I_F = 10 mA

Series Name	Color	Part Number	Typical Luminous Intensity Iv (mcd) @I_F = 20 mA Min	Typ.	Forward Voltage V_F (V) @I_F = 20 mA Typ.	Max	Reverse Voltage V_R (V) @I_R = 10 mA Typ.	Chromaticity @I_F = 20 mA Cx Min	Cx Typ.	Cx Max	Cy Min	Cy Typ.	Cy Max
TL✻J Series (InGaN)	White	NEW ☆ TLWJ1100(T11)	400	750	3.3	4.0	0.75		(Note 2)			(Note 2)	
TL✻H Series (GaN)	White	☆ TLWH1100(T11)	250	450	3.5	4.2	0.75		(Note 2)			(Note 2)	
TL✻D Series (InGaN)	White	NEW ☆ TLWD1100(T11)	63	180	3.3	4.0	—		(Note 2)			(Note 2)	
TL✻A Series (GaN)	White	☆ TLWA1100(T11)	63	100	3.5	4.2	0.75		(Note 2)			(Note 2)	
	Bluish green	☆ TLBGA1100(T11)	63	100	3.5	4.2	0.75	—	0.15	—	—	0.32	—
	Reddish purple	☆ TLRPA1100(T11)	40	70	3.5	4.2	0.75	—	0.35	—	—	0.20	—

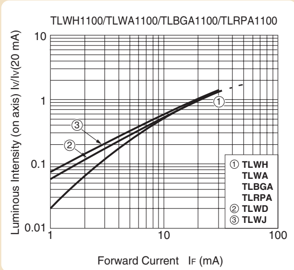
☆: Sealed in a moisture-proof bag. Note 2: See "Chromaticity ranking of the TLWJ1100, TLWD1100, TLWH1100 and TLWA1100" on page 23.

Typical Characteristics

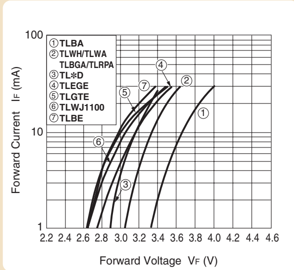
IV – IF



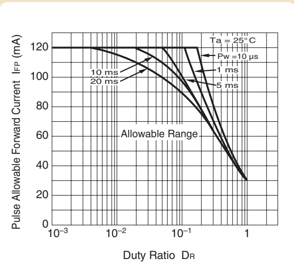
IV/IV(20 mA) – IF



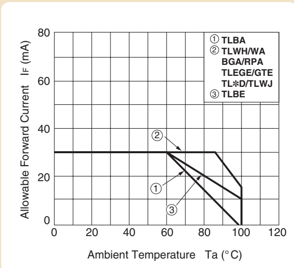
IF – VF



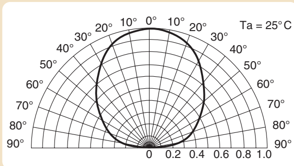
Pulse allowable forward current characteristics



IF – Ta

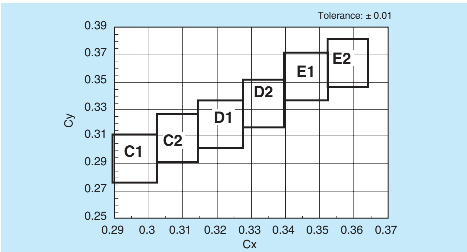


Radiation pattern



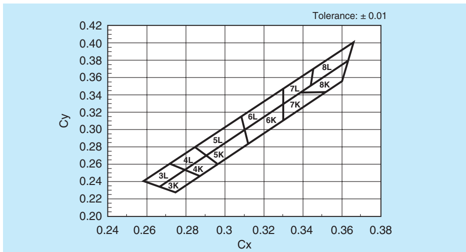
Chromaticity ranking of the TLWH1100 and TLWA1100

The devices are classified into groups of chromaticity coordinates as shown below. For details, contact your nearest Toshiba sales office.

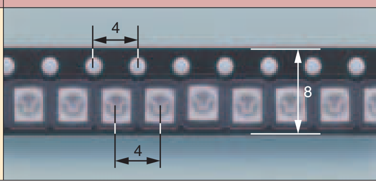
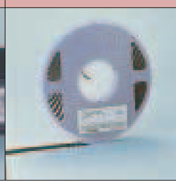


Chromaticity ranking of the TLWJ1100 and TLWD1100

The devices are classified into groups of chromaticity coordinates as shown below. For details, contact your nearest Toshiba sales office.

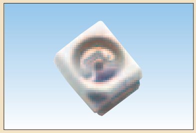


Tape and Reel Specifications

Tape Type	Suffix to Part Number	Pitch	Packing Container		Quantity / Reel
			Tape dimensions (mm)	Appearance	
Embossed tape	T11	4 mm			2000 pcs / reel

7. TL✻H1106(T11)

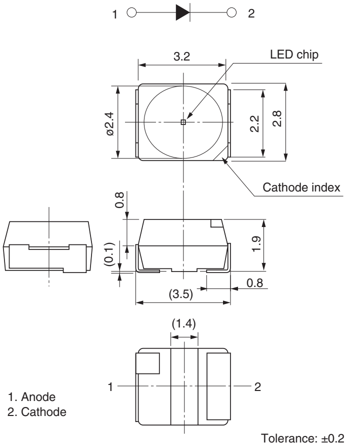
Features



- Package dimensions: 2.2 (L) x 1.4 (W) x 1.3 (H) mm
- High-current drive
- Resin with high heat resistance used for the package extends the range of the operating temperature.
  Topr = –40 to 100°C
- Lead(Pb)-free reflow soldering

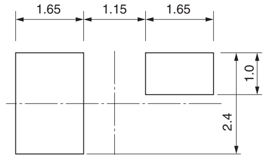
Package Dimensions

(Unit: mm)



Recommended Soldering Patterns

(Unit: mm)



*Refer to relevant technical datasheets.

Absolute Maximum Ratings

Ta = 25°C

Characteristic	Symbol	Rating	Unit
Forward Current (DC)	I_F	70	mA
Reverse Voltage	V_R	4	V
Power Dissipation	P_D	175	mW
Operating Temperature	Topr	−40 to 100	°C
Storage Temperature	Tstg	−40 to 100	°C

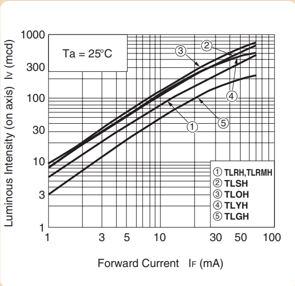
Electrical and Optical Characteristics

Series Name	Color	Part Number	Typical Luminous Intensity I_V (mcd) @I_F = 50 mA		Forward Voltage V_F (V) @I_F = 50 mA		Reverse Current I_R (μA) @V_R = 4 V	Typical Emission Wavelength (nm) @I_F = 50 mA		
			Min	Typ.	Typ.	Max	Max	λp	Δλ	λd
TL✻H Series (InGaAℓP)	Red	☆ **TLRH1106(T11)**	160	380	2.1	2.5	10	644	18	630
	Red	☆ **TLRMH1106(T11)**	160	380	2.1	2.5	10	636	17	626
	Red	☆ **TLSH1106(T11)**	250	500	2.2	2.5	10	623	17	613
	Orange	☆ **TLOH1106(T11)**	250	600	2.2	2.5	10	612	15	605
	Yellow	☆ **TLYH1106(T11)**	250	450	2.2	2.5	10	590	15	587
	Green	☆ **TLGH1106(T11)**	100	200	2.2	2.5	10	574	11	571

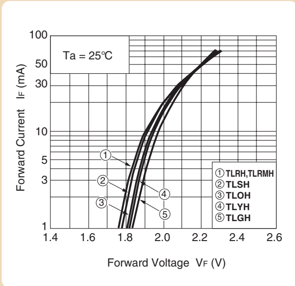
☆: Sealed in a moisture-proof bag.

Typical Characteristics

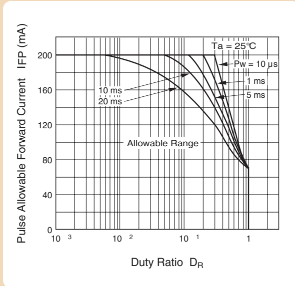
Iv – IF



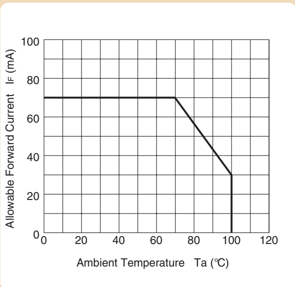
IF – VF



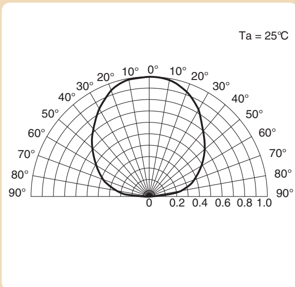
Pulse allowable forward current characteristics

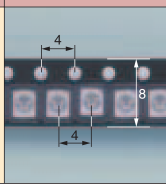
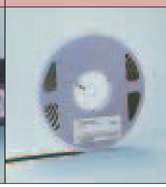


IF – Ta



Radiation pattern

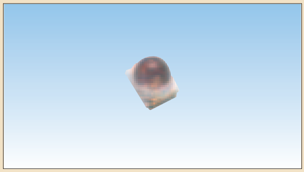


Tape Type	Suffix to Part Number	Pitch	Packing Container		Quantity / Reel
			Tape dimensions (mm)	Appearance	
Embossed tape	T11	4 mm			2000 pcs / reel

8. TL✻H1102B(T10), TL✻E1102B(T10)

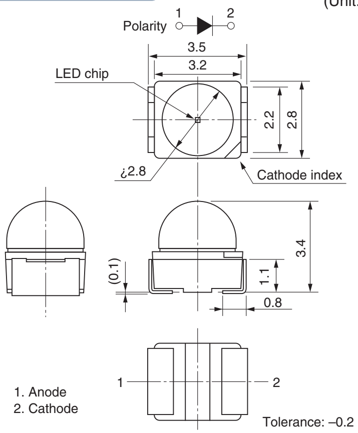
Features

- Package dimensions: 3.2 (L) x 2.8 (W) x 3.4 (H) mm
- Four-element (InGaAℓP) high-brightness LED
- Resin with high heat resistance is used for the package; the device can operate in high temperatures.
  Wide operating temperature range:
  Topr = —40 to 100° C



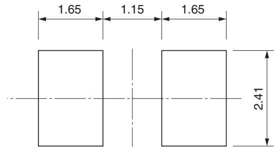
Package Dimensions

(Unit: mm)



Recommended Soldering Patterns

(Unit: mm)



Absolute Maximum Ratings

Ta = 25℃

Characteristic	Symbol	Rating	Unit
DC Forward Current	I_F	50	mA
DC Reverse Voltage	V_R	4	V
Power Dissipation	P_D	115 to 120 (Note 1)	mW
Operating Temperature	Topr	40 to 100	℃
Storage Temperature	Tstg	40 to 100	℃

Note 1: Refer to the relevant technical datasheet.

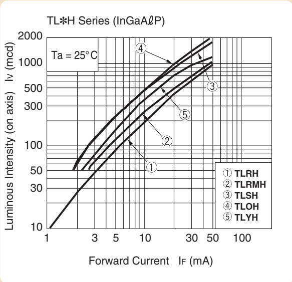
Electrical and Optical Characteristics

Series Name	Color	Part Number	Typical Luminous Intensity Iv (mcd) @IF = 20 mA		Forward Voltage VF (V) @IF = 20 mA		Reverse Current IR (μA) @VR = 4 V	Typical Emission Wavelength (nm) @IF = 20 mA		
			Min	Typ.	Typ.	Max	Max	λp	Δλ	λd
TL✻H Series (InGaAℓP)	Red	NEW ☆ TLRH1102B(T10)	160	400	1.9	2.3	10	644	18	630
	Red	NEW ☆ TLRMH1102B(T10)	160	480	1.9	2.3	10	636	17	626
	Red	NEW ☆ TLSH1102B(T10)	400	850	1.9	2.3	10	623	17	613
	Orange	NEW ☆ TLOH1102B(T10)	400	950	2.0	2.3	10	612	15	605
	Yellow	NEW ☆ TLYH1102B(T10)	250	700	2.0	2.3	10	590	15	587
TL✻E Series (InGaAℓP)	Red	☆ TLRE1102B(T10)	100	320	1.9	2.4	50	644	18	630
	Red	☆ TLSE1102B(T10)	250	600	1.9	2.4	50	623	15	613
	Orange	☆ TLOE1102B(T10)	250	650	2.0	2.4	50	612	15	605
	Yellow	☆ TLYE1102B(T10)	160	480	2.0	2.4	50	590	13	587
	Green	☆ TLGE1102B(T10)	100	300	2.0	2.4	50	574	11	571
	Pure green	☆ TLPGE1102B(T10)	25	75	2.1	2.4	50	562	11	558

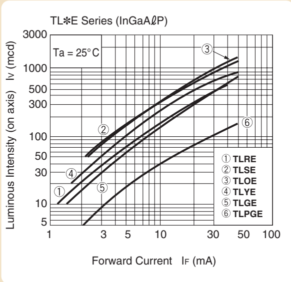
☆: Sealed in a moisture-proof bag.

Typical Characteristics

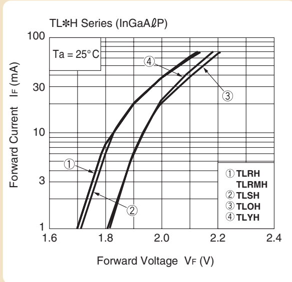
Iv – IF



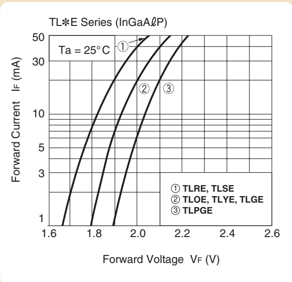
Iv – IF



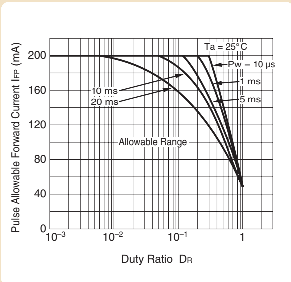
IF – VF



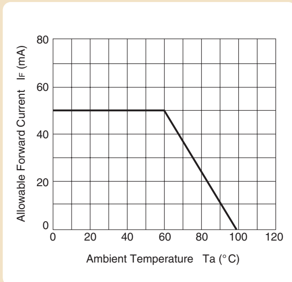
IF – VF



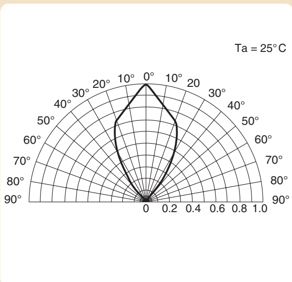
Pulse allowable forward current characteristics



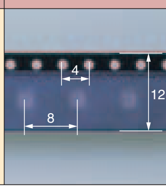
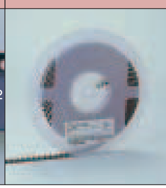
IF – Ta



Radiation pattern



Tape and Reel Specifications

Tape Type	Suffix to Part Number	Pitch	Packing Container		Quantity / Reel
			Tape dimensions (mm)	Appearance	
Embossed tape	T10	8 mm			500 pcs / reel

4. Product List for the Through-Hole Type

1. Electrical and Optical Characteristics

Toshiba offers high-brightness LED series by developing four-element (InGaAℓP) high-brightness LEDs and designing optimum lenses. Select the appropriate product for your application.

Type I (three-digit package number)

Series Name	Absolute Maximum Ratings					Electrical / Optical Characteristics								
	DC forward current I_F (mA)	DC reverse voltage V_R (V)	Power dissipation P_D (mW)	Operating temperature T_{opr} (°C)	Storage temperature T_{stg} (°C)	Forward voltage V_F (V)			Reverse current I_R (μA)		Typical Emission Wavelength			
						typ.	max	I_F (mA)	max	V_R (V)	Peak wave-length λp	Spectral line half width Δλ	Dominant wavelength λd	I_F (mA)
TLSU Series	**30**	**4**	**72**	**Note 1**	**—**	**2.0**	**2.4**	**20**	**50**	**4**	**636**	**17**	**623**	**20**
TLOU Series	**30**	**4**	**72**	**Note 2**	**—**	**2.0**	**2.4**	**20**	**50**	**4**	**612**	**15**	**605**	**20**
TLYU Series	**30**	**4**	**75**	**Note 3**	**—**	**2.1**	**2.5**	**20**	**50**	**4**	**590**	**13**	**587**	**20**

* Some product specifications differ from the series specifications given above. For details, refer to the relevant technical datasheet.
Note 1: For operating and storage temperatures, see page 33.
Note 2: For operating and storage temperatures, see page 35.
Note 3: For operating and storage temperatures, see page 37.

Type II (two-digit package number)

SeriesName	Absolute Maximum Ratings					Electrical / Optical Characteristics								
	DC forward current I_F (mA)	DC reverse voltage V_R (V)	Power dissipation P_D (mW)	Operating temperature T_{opr} (°C)	Storage temperature T_{stg} (°C)	Forward voltage V_F (V)			Reverse current I_R (μA)		Typival Emission Wavelength			
						typ.	max	I_F (mA)	max	V_R (V)	Peak wavelength λp	Spectal line half width Δλ	Dominant wavelength λd	I_F (mA)
TLRH Series	50	4	120	−40 to 100	−40 to 120	1.9	2.4	20	50	4	644	18	630	20
TLRE Series	50	4	120	−40 to 100	−40 to 120	1.9	2.4	20	50	4	644	20	630	20
TLRMK Series	50	4	130	−40 to 100	−40 to 120	2.4	2.6	20	50	4	636	13	626	20
TLRMH Series	50	4	120	−40 to 100	−40 to 120	1.9	2.4	20	50	4	636	13	626	20
TLRME Series	50	4	120	−40 to 100	−40 to 120	1.9	2.4	20	50	4	636	23	626	20
TLSH Series	50	4	120	−40 to 100	−40 to 120	2.0	2.4	20	50	4	623	13	613	20
TLSE Series	50	4	120	−40 to 100	−40 to 120	1.9	2.4	20	50	4	623	20	613	20
TLOH Series	50	4	120	−40 to 100	−40 to 120	2.0	2.4	20	50	4	612	13	605	20
TLOE Series	50	4	120	−40 to 100	−40 to 120	2.0	2.4	20	50	4	612	20	605	20
TLYK Series	50	4	130	−40 to 100	−40 to 120	2.4	2.6	20	50	4	594	13	590	20
TLYH Series	50	4	120	−40 to 100	−40 to 120	2.0	2.4	20	50	4	590	13	587	20
TLYE Series	50	4	120	−40 to 100	−40 to 120	2.0	2.4	20	50	4	590	17	587	20
TLPYE Series	50	4	120	−40 to 100	−40 to 120	2.0	2.4	20	50	4	583	14	580	20
TLGE Series	50	4	120	−40 to 100	−40 to 120	2.0	2.4	20	50	4	574	17	571	20
TLGU Series	30	4	72	−40 to 100	−40 to 120	2.1	2.4	20	50	4	574	17	571	20
TLFGE Series	50	4	120	−40 to 100	−40 to 120	2.0	2.4	20	50	4	568	15	565	20
TLPGE Series	50	4	120	−40 to 100	−40 to 120	2.1	2.4	20	50	4	562	14	558	20
TLPGU Series	30	4	72	−40 to 100	−40 to 120	2.1	2.4	20	50	4	562	14	558	20
TLGTC Series	30	5	120	−40 to 85	−40 to 100	3.3	4.0	20	50	4	503	30	505	20
TLRMHGH Series	50(Total)	4	120	−40 to 100	−40 to 120	1.95	2.4	20	50	4	636	13	626	20
						2.05	2.4				574	13	571	

* When designing a circuit in which an LED is used, refer to the relevant technical datasheet.

2. Package Selection Guide

Package Size	Viewing Angle	Part Number
ø5	5°	23TP
	6°	180P
	7°	20TP, 20CP
	12°	38TP
	18°	19TP, 19CP
	20°	156P, 172P, 17TP, 17CP
	25°	16TP, 16CP, 17DP
	30°	113P, 18TP, 18CP, 48T, 30TP, 31TP , 32TP
	40°	114P, 48M, 30MP
	45°	13CP
	55°	13DP
	75°	25TP
	130°	11TP

Package Size	Viewing Angle	Part Number
Arched 5 x 2.5	10°	33TP, 33CP
Oval 5 x 5.8	30°/45°	248
	30°/50°	27C
	40°/70°	27T
Oval 5 x 4.3	80°/50°	28C
ø3	9°	160, 163
	10°	50T ※TL✻U Series
	16°	50T, 50C
	18°	164
	35°	123, 125
	40°	124, 126, 53T, 53C ※TL✻U Series
	45°	53T
	50°	53D
	60°	262, 267
	80°	268G, 62T, 68TG, 68CG
	100°	68DG
	120°	60T

※For details, refer to the Product List for the Through-Hole Type, pages 30 to 41.

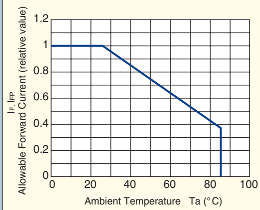
3. High-Brightness Red LED Lamps

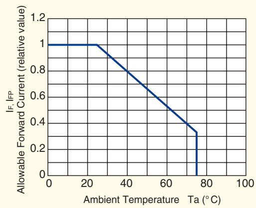
Series Name	Package Size (mm)	Viewing Angle 2Θ 1/2	Luminous Intensity Iv (mcd) @IF = 20 mA		Part Number	Typical Emission Wavelength IF = 20 mA		Lens Color	
			Min	Typ.		λd (nm)	λp (nm)		Guaranteed temperature
TL✻K Series (InGaAℓP)	ø5	23°	1530	5700	**TLRMK16TP(F)**	626	636	Transparent	✻3
		30°	850	3000	**TLRMK31TP(F)**	626	636	Transparent	✻3
TL✻H Series (InGaAℓP)	ø5	7°	4760	11000	**TLSH20TP(F)**	613	623	Transparent	✻3
			2720	9000	**TLRMH20TP(F)**	626	636	Transparent	✻3
		12°	2720	6500	**TLSH38TP(F)**	613	623	Transparent	✻3
			1530	4800	**TLRMH38TP(F)**	626	636	Transparent	✻3
		20°	1530	4500	**TLSH17TP(F)**	613	623	Transparent	✻3
			850	3200	**TLRMH17TP(F)**	626	636	Transparent	✻3
			850	2000	**TLRH17TP(F)**	630	644	Transparent	✻3
		25°	850	1900	**TLSH16TP(F)**	613	623	Transparent	✻3
			476	1500	**TLRMH16TP(F)**	626	636	Transparent	✻3
		33°	476	1300	**TLSH30TP(F)**	613	623	Transparent	✻3
			476	950	**TLRMH30TP(F)**	626	636	Transparent	✻3
			272	680	**TLRH30TP(F)**	630	644	Transparent	✻3
		40°	272	600	**TLRMH30MP(F)**	626	636	Milky white diffused	✻3
	ø3	16°	2720	4700	**TLSH50T(F)**	613	623	Transparent	✻3
			850	2000	**TLRH50T(F)**	630	644	Transparent	✻3
		80°	47.6	180	**TLRH62T(F)**	630	644	Transparent	✻3
	Oval 5 x 5.8	40°/ 70°	153	450	**TLRH27T(F)**	630	644	Transparent	✻3
TL✻E Series (InGaAℓP)	ø5	7°	4760	12000	**TLRME20CP(F)**	626	636	Red transparent	✻3
			2720	9000	**TLSE20TP(F)**	613	623	Transparent	✻3
			2720	8000	**TLRME20TP(F)**	626	636	Transparent	✻3
			2720	7000	**TLRE20TP(F)**	630	644	Transparent	✻3
		20°	850	3000	**TLSE17TP(F)**	613	623	Transparent	✻3
			850	2400	**TLRME17TP(F)**	626	636	Transparent	✻3
			476	1500	**TLRE17TP(F)**	630	644	Transparent	✻3
		25°	476	1500	**TLSE16TP(F)**	613	623	Transparent	✻3
			476	1000	**TLSE16CP(F)**	613	623	Red transparent	✻3
			272	1200	**TLRME16TP(F)**	626	636	Transparent	✻3
			272	800	**TLRE16TP(F)**	630	644	Transparent	✻3
			272	800	**TLRME16CP(F)**	626	636	Red transparent	✻3
			153	600	**TLRE16CP(F)**	630	644	Red transparent	✻3
			153	500	**TLRME17DP(F)**	626	636	Red diffused	✻3
		30°	272	1000	**TLSE30TP(F)**	613	623	Transparent	✻3
			153	600	**TLRE30TP(F)**	630	644	Transparent	✻3
		75°	47.6	150	**TLRE25TP(F)**	630	644	Transparent	✻3
		130°	8.5	20	**TLRE11TP(F)**	630	644	Transparent	✻3

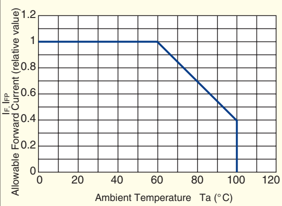
◆: Designed for flush mounting. * When designing a circuit in which an LED is used, refer to the relevant technical datasheet.
Note: Refer to page 9 for information on pulse operation. Also, refer to page 3 for product number format.

@Ta = 25°C

Absolute Maximum Ratings		Package Dimension Number	Applications
DC forward current IF (mA)	Pulse forward current IFP (mA) (Note)		
50	200	ø5-3	Pilot lamps(narrow range)
50	200	ø5-13	Message boards, Backlighting
50	200	ø5-1	Pilot lamps (narrow range)
50	200	ø5-1	
50	200	ø5-4	
50	200	ø5-4	
50	200	ø5-2	Message boards Backlighting
50	200	ø5-2	
50	200	ø5-2	Pilot lamps(narrow range)
50	200	ø5-3	Message boards Backlighting
50	200	ø5-3	
50	200	ø5-14	
50	200	ø5-14	
50	200	ø5-14	
50	200	ø5-14	
50	200	ø3-3	Pilot lamps
50	200	ø3-3	
50	200	ø3-2	Backlighting (wide range)
50	200	Oval-1	Message boards
50	200	ø5-1	Message boards Backlighting
50	200	ø5-1	
50	200	ø5-1	
50	200	ø5-1	
50	200	ø5-2	Backlighting (wide range)
50	200	ø5-2	
50	200	ø5-2	
50	200	ø5-3	
50	200	ø5-3	
50	200	ø5-3	
50	200	ø5-3	
50	200	ø5-3	
50	200	ø5-3	
50	200	ø5-2	
50	200	ø5-14	Message boards Backlighting
50	200	ø5-14	
50	200	ø5-6	Pilot lamps
50	200	ø5-7	

Characteristics	✻1
Forward Current Derating Curve	
Operating Temperature	−30°C to 85°C
Storage Temperature	−40°C to 120°C

Characteristics	✻2
Forward Current Derating Curve	
Operating Temperature	−20°C to 75°C
Storage Temperature	−30°C to 100°C

Characteristics	✻3
Forward Current Derating Curve	
Operating Temperature	−40°C to 100°C
Storage Temperature	−40°C to 120°C

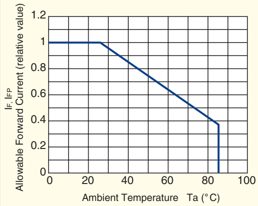
4. Product List for the Through-Hole Type

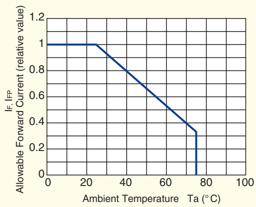
Series Name	Package Size (mm)	Viewing Angle 2Θ 1/2	Luminous Intensity Iv (mcd) @IF = 20 mA		Part Number	Typical Emission Wavelength IF = 20 mA		Lens Color	
			Min	Typ.		λd (nm)	λp (nm)		Guaranteed temperature
TL✻E Series (InGaAℓP)	ø3	16°	1530	3500	**TLRME50C(F)**	626	636	Red transparent	✻3
			1530	3500	**TLSE50T(F)**	613	623	Transparent	✻3
			850	2200	**TLRME50T(F)**	626	636	Transparent	✻3
			850	1800	**TLRE50T(F)**	630	644	Transparent	✻3
		45°	272	800	**TLSE53T(F)**	613	623	Transparent	✻3
			272	600	**TLRME53T(F)**	626	636	Transparent	✻3
			153	400	**TLRE53T(F)**	630	644	Transparent	✻3
		80°	85	330	◆ **TLRME68TG(F)**	626	636	Transparent	✻3
			85	260	◆ **TLRME68CG(F)**	626	636	Red transparent	✻3
			85	200	**TLSE62T(F)**	613	623	Transparent	✻3
			47.6	180	**TLRME62T(F)**	626	636	Transparent	✻3
			47.6	120	**TLRE62T(F)**	630	644	Transparent	✻3
		100°	47.6	140	◆ **TLRME68DG(F)**	626	636	Red diffused	✻3
		120°	15.3	45	**TLRE60T(F)**	630	644	Transparent	✻3
	Oval 5 x 5.8	30°/ 50°	272	750	**TLSE27C(F)**	613	623	Red transparent	✻3
			153	400	**TLRME27C(F)**	626	636	Red transparent	✻3
			85	300	**TLRE27C(F)**	630	644	Red transparent	✻3
	Oval 4.3 x 5	80°/ 50°	85	200	**TLRE28C(F)**	630	644	Red transparent	✻3
			85	200	**TLRME28C(F)**	626	636	Red transparent	✻3
			85	300	**TLSE28C(F)**	613	623	Red transparent	✻3
TL✻U Series (InGaAℓP)	ø5	6°	1530	4500	**TLSU180P(F)**	623	636	Transparent	✻1
		20°	272	900	**TLSU156P(F)**	623	636	Transparent	✻1
		30°	153	550	**TLSU113P(F)**	623	636	Red transparent	✻2
		40°	47.6	250	**TLSU114P(F)**	623	636	Red diffused	✻2
	ø3	9°	476	4000	**TLSU163(F)**	623	636	Pale red transparent	✻1
			476	1600	**TLSU160(F)**	623	636	Transparent	✻1
		18°	153	450	**TLSU164(F)**	623	636	Pale red diffused	✻1
		35°	153	300	**TLSU125(F)**	623	636	Transparent	✻1
			85	270	**TLSU123(F)**	623	636	Red transparent	✻2
		40°	85	180	**TLSU126(F)**	623	636	Milky white diffused	✻1
			47.6	100	**TLSU124(F)**	623	636	Red diffused	✻2
		60°	47.6	170	**TLSU262(F)**	623	636	Transparent	✻1
		80°	47.6	130	◆ **TLSU268G(F)**	623	636	Transparent	✻1

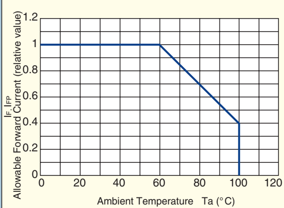
◆: Designed for flush mounting. * When designing a circuit in which an LED is used, refer to the relevant technical datasheet.
Note: Refer to page 9 for information on pulse operation. Also, refer to page 3 for product number format.

@Ta = 25°C

Absolute Maximum Ratings		Package Dimension Number	Applications
DC forward current IF (mA)	Pulse forward current IFP (mA) (Note)		
50	200	ø3-3	Pilot lamps
50	200	ø3-3	
50	200	ø3-3	
50	200	ø3-3	
50	200	ø3-4	
50	200	ø3-4	
50	200	ø3-4	
50	200	ø3-5	Backlighting (wide range)
50	200	ø3-5	
50	200	ø3-2	
50	200	ø3-2	
50	200	ø3-2	
50	200	ø3-5	
50	200	ø3-1	
50	200	Oval-1	Message boards
50	200	Oval-1	
50	200	Oval-1	
50	200	Oval-2	Message boards
50	200	Oval-2	
50	200	Oval-2	
30	120	ø5-1	Pilot lamps (narrow range)
30	120	ø5-3	Message boards Backlighting
30	120	ø5-5	
30	120	ø5-5	
30	120	ø3-3	Pilot lamps
30	120	ø3-3	
30	120	ø3-3	
30	120	ø3-4	
30	120	ø3-4	
30	120	ø3-4	
30	120	ø3-4	
30	120	ø3-2	Backlighting (narrow range)
30	120	ø3-5	

Characteristics	✻1
Forward Current Derating Curve	
Operating Temperature	−30°C to 85°C
Storage Temperature	−40°C to 120°C

Characteristics	✻2
Forward Current Derating Curve	
Operating Temperature	−20°C to 75°C
Storage Temperature	−30°C to 100°C

Characteristics	✻3
Forward Current Derating Curve	
Operating Temperature	−40°C to 100°C
Storage Temperature	−40°C to 120°C

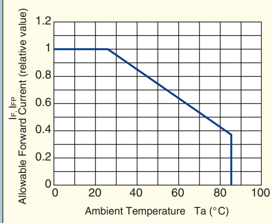
4. High-Brightness Orange LED Lamps

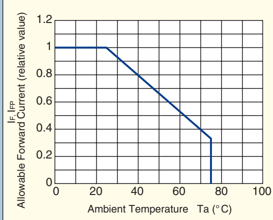
Series Name	Package Size (mm)	Viewing Angle 2θ 1/2	Luminous Intensity Iv (mcd) @IF = 20 mA		Part Number	Typical Emission Wavelength IF = 20 mA		Lens Color	Guaranteed temperature
			Min	Typ.		λd (nm)	λp (nm)		
TL*H Series (InGaAℓP)	ø5	7°	4760	15000	**TLOH20TP(F)**	605	612	Transparent	*3
		12°	2720	7500	**TLOH38TP(F)**	605	612	Transparent	*3
		20°	1530	5000	**TLOH17TP(F)**	605	612	Transparent	*3
		25°	850	2300	**TLOH16TP(F)**	605	612	Transparent	*3
	ø3	16°	1530	5800	**TLOH50T(F)**	605	612	Transparent	*3
		80°	153	550	**TLOH62T(F)**	605	612	Transparent	*3
TL*E Series (InGaAℓP)	ø5	7°	4760	10000	**TLOE20TP(F)**	605	612	Transparent	*3
		20°	1530	4500	**TLOE17TP(F)**	605	612	Transparent	*3
			1530	3500	**TLOE17CP(F)**	605	612	Orange transparent	*3
		25°	850	2000	**TLOE16TP(F)**	605	612	Transparent	*3
			476	1600	**TLOE16CP(F)**	605	612	Orange transparent	*3
		30°	476	1400	**TLOE30TP(F)**	605	612	Transparent	*3
		33°	476	1600	**TLOH30TP(F)**	605	612	Transparent	*3
		75°	153	350	**TLOE25TP(F)**	605	612	Transparent	*3
		130°	27.2	65	**TLOE11TP(F)**	605	612	Transparent	*3
	ø3	16°	2720	7000	**TLOE50C(F)**	605	612	Orange transparent	*3
			1530	4500	**TLOE50T(F)**	605	612	Transparent	*3
		45°	272	1000	**TLOE53T(F)**	605	612	Transparent	*3
		80°	153	350	**TLOE62T(F)**	605	612	Transparent	*3
		120°	27.2	100	**TLOE60T(F)**	605	612	Transparent	*3
	Oval 5 x 5.8	30°/ 50°	272	800	**TLOE27C(F)**	605	612	Orange transparent	*3
	Oval 4.3 x 5	80°/ 50°	153	500	**TLOE28C(F)**	605	612	Orange transparent	*3
	Arched 5 x 2.5	10°	1530	4000	**TLOE33CP(F)**	605	612	Orange transparent	*3
TL*U Series (InGaAℓP)	ø5	6°	2720	7000	**TLOU180P(F)**	605	612	Transparent	*1
		20°	476	900	**TLOU156P(F)**	605	612	Transparent	*1
			476	800	**TLOU172P(F)**	605	612	Orange transparent	*1
		30°	272	900	**TLOU113P(F)**	605	612	Orange transparent	*2
		40°	47.6	250	**TLOU114P(F)**	605	612	Orange diffused	*2
	ø3	9°	476	2500	**TLOU160(F)**	605	612	Transparent	*1
		35°	85	400	**TLOU123(F)**	605	612	Orange transparent	*2
		40°	47.6	180	**TLOU124(F)**	605	612	Orange diffused	*2
		60°	47.6	300	**TLOU262(F)**	605	612	Transparent	*1
			47.6	200	**TLOU267(F)**	605	612	Orange transparent	*1
	Oval 5 x 5.8	30°/ 45°	85	450	**TLOU248(F)**	605	612	Orange transparent	*1

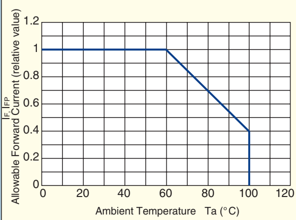
* When designing a circuit in which an LED is used, refer to the relevant technical datasheet.
Note: Refer to page 9 for information on pulse operation. Also, refer to page 3 for product number format.

@Ta = 25°C

Absolute Maximum Ratings		Package Dimension Number	Applications
DC forward current IF (mA)	Pulse forward current IFP (mA) (Note)		
50	200	ø5-1	Pilot lamps (narrow range)
50	200	ø5-4	
50	200	ø5-2	
50	200	ø5-3	Message boards, Backlighting
50	200	ø3-3	Pilot lamps
50	200	ø3-2	Backlighting (wide range)
50	200	ø5-1	Pilot lamps (narrow range)
50	200	ø5-2	
50	200	ø5-2	
50	200	ø5-3	Message boards Backlighting
50	200	ø5-3	
50	200	ø5-14	
50	200	ø5-14	
50	200	ø5-6	Backlighting (wide range)
50	200	ø5-7	
50	200	ø3-3	Pilot lamps
50	200	ø3-3	
50	200	ø3-4	Backlighting (wide range)
50	200	ø3-2	
50	200	ø3-1	
50	200	Oval-1	Message boards
50	200	Oval-2	
50	200	Arched-1	Backlighting
30	120	ø5-1	Pilot lamps (narrow range)
30	120	ø5-3	
30	120	ø5-3	
30	120	ø5-5	Message boards Backlighting
30	120	ø5-5	
30	120	ø3-3	Pilot lamps
30	120	ø3-4	
30	120	ø3-4	
30	120	ø3-2	Backlighting (wide range)
30	120	ø3-2	
30	120	Oval-1	Message boards

Characteristics	✻1
Forward Current Derating Curve	
Operating Temperature	−30°C to 85°C
Storage Temperature	−40°C to 120°C

Characteristics	✻2
Forward Current Derating Curve	
Operating Temperature	−20°C to 75°C
Storage Temperature	−30°C to 100°C

Characteristics	✻3
Forward Current Derating Curve	
Operating Temperature	−40°C to 100°C
Storage Temperature	−40°C to 120°C

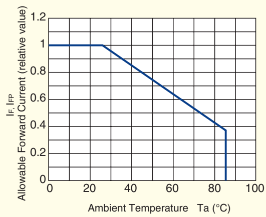
5. High-Brightness Yellow LED Lamps

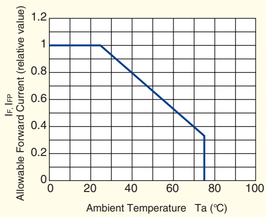
Series Name	Package Size (mm)	Viewing Angle 2Θ 1/2	Luminous Intensity Iv (mcd) @IF = 20 mA		Part Number	Typical Emission Wavelength IF = 20 mA		Lens Color	
			Min	Typ.		λd (nm)	λp (nm)		Guaranteed temperature
TL*K Series (InGaAℓP)	ø5	23°	2720	6800	**TLYK16TP(F)**	587	590	Transparent	*3
		30°	1530	4000	**TLYK31TP(F)**	587	590	Transparent	*3
TL*H Series (InGaAℓP)	ø5	7°	4760	13000	**TLYH20TP(F)**	587	590	Transparent	*3
		12°	2720	7000	**TLYH38TP(F)**	587	590	Transparent	*3
		20°	1530	4800	**TLYH17TP(F)**	587	590	Transparent	*3
		25°	850	2200	**TLYH16TP(F)**	587	590	Transparent	*3
		33°	476	1350	**TLYH30TP(F)**	587	590	Transparent	*3
	ø3	16°	1530	4400	**TLYH50T(F)**	587	590	Transparent	*3
		80°	272	520	**TLYH68TG(F)**	587	590	Transparent	*3
			153	400	**TLYH62T(F)**	587	590	Transparent	*3
	Oval 5 x 5.8	40°/ 70°	272	900	**TLYH27T(F)**	587	590	Transparent	*3
	Oval 4.3 x 5	70°/ 50°	272	750	**TLYH28C(F)**	587	590	Yellow transparent	*3
TL*E Series (InGaAℓP)	ø5	5°	2720	8000	**TLPYE23TP(F)**	580	583	Transparent	*3
		7°	2720	9500	**TLYE20TP(F)**	587	590	Transparent	*3
		18°	476	2000	**TLPYE19TP(F)**	580	583	Transparent	*3
		20°	850	3000	**TLYE17CP(F)**	587	590	Yellow transparent	*3
			850	3000	**TLYE17TP(F)**	587	590	Transparent	*3
		25°	476	1500	**TLYE16TP(F)**	587	590	Transparent	*3
			476	1200	**TLYE16CP(F)**	587	590	Yellow transparent	*3
		30°	476	1300	**TLYE30TP(F)**	587	590	Transparent	*3
			272	750	**TLPYE18TP(F)**	580	583	Transparent	*3
		75°	85	300	**TLYE25TP(F)**	587	590	Transparent	*3
		130°	15.3	45	**TLYE11TP(F)**	587	590	Transparent	*3
	ø3	16°	1530	3500	**TLYE50C(F)**	587	590	Yellow transparent	*3
			1530	3500	**TLYE50T(F)**	587	590	Transparent	*3
			850	2500	**TLPYE50T(F)**	580	583	Transparent	*3
		45°	272	800	**TLYE53T(F)**	587	590	Transparent	*3
			153	450	**TLPYE53T(F)**	580	583	Transparent	*3
		80°	85	340	◆ **TLYE68TG(F)**	587	590	Transparent	*3
			85	300	◆ **TLYE68CG(F)**	587	590	Yellow transparent	*3
			85	250	**TLYE62T(F)**	587	590	Transparent	*3
			47.6	150	**TLPYE62T(F)**	580	583	Transparent	*3
		100°	47.6	150	◆ **TLYE68DG(F)**	587	590	Yellow diffused	*3
		120°	27.2	85	**TLYE60T(F)**	587	590	Transparent	*3
	Oval 5 x 5.8	30°/ 50°	272	650	**TLYE27C(F)**	587	590	Yellow transparent	*3
	Oval 4.3 x 5	80°/ 50°	153	350	**TLYE28C(F)**	587	590	Yellow transparent	*3
	Arched 5 x 2.5	10°	476	1400	**TLPYE33CP(F)**	580	583	Yellow transparent	*3
			1530	3500	**TLYE33CP(F)**	587	590	Yellow transparent	*3
TL*U Series (InGaAℓP)	ø5	6°	850	4300	**TLYU180P(F)**	587	590	Transparent	*1
		20°	153	500	**TLYU156P(F)**	587	590	Transparent	*1
			153	400	**TLYU172P(F)**	587	590	Yellow transparent	*1
		30°	153	500	**TLYU113P(F)**	587	590	Yellow transparent	*2
		40°	47.6	130	**TLYU114P(F)**	587	590	Yellow diffused	*2
	ø3	9°	476	1500	**TLYU160(F)**	587	590	Transparent	*1
		35°	85	220	**TLYU123(F)**	587	590	Yellow transparent	*2
		40°	47.6	110	**TLYU124(F)**	587	590	Yellow diffused	*2
		60°	47.6	150	**TLYU262(F)**	587	590	Transparent	*1
			47.6	90	**TLYU267(F)**	587	590	Yellow transparent	*1

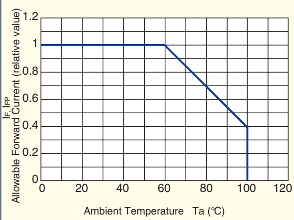
◆: Designed for flush mounting.
* When designing a circuit in which an LED is used, refer to the relevant technical datasheet.
Note: Refer to page 9 for information on pulse operation. Also, refer to page 3 for product number format.

@Ta = 25℃

Absolute Maximum Ratings		Package Dimension Number	Applications
DC forward current I_F (mA)	Pulse forward current I_{FP} (mA)(Note)		
50	200	ø5-3	Pilot lamps (narrow range)
50	200	ø5-13	Message boards, Backlighting
50	200	ø5-1	Pilot lamps (narrow range)
50	200	ø5-4	
50	200	ø5-2	
50	200	ø5-3	Message boards Backlighting
50	200	ø5-14	
50	200	ø3-3	Pilot lamps
50	200	ø3-5	Backlighting (wide range)
50	200	ø3-2	
50	200	Oval-1	Message boards
50	200	Oval-2	
50	200	ø5-9	Pilot lamps (narrow range)
50	200	ø5-1	
50	200	ø5-10	
50	200	ø5-2	
50	200	ø5-2	
50	200	ø5-3	Message boards Backlighting
50	200	ø5-3	
50	200	ø5-14	
50	200	ø5-11	
50	200	ø5-6	Backlighting (wide range)
50	200	ø5-7	
50	200	ø3-3	Pilot lamps
50	200	ø3-3	
50	200	ø3-3	
50	200	ø3-4	
50	200	ø3-4	
50	200	ø3-5	Backlighting (wide range)
50	200	ø3-5	
50	200	ø3-2	
50	200	ø3-2	
50	200	ø3-5	
50	200	ø3-1	
50	200	Oval-1	Message boards
50	200	Oval-2	
50	200	Arched-1	Backlighting
50	200	Arched-1	
30	120	ø5-1	Pilot lamps (narrow range)
30	120	ø5-3	
30	120	ø5-3	
30	120	ø5-5	Message boards Backlighting
30	120	ø5-5	
30	120	ø3-3	Pilot lamps
30	120	ø3-4	
30	120	ø3-4	
30	120	ø3-2	Backlighting (wide range)
30	120	ø3-2	

Characteristics	1
Forward Current Derating Curve	
Operating Temperature	−30° C to 85° C
Storage Temperature	−40° C to 120° C

Characteristics	2
Forward Current Derating Curve	
Operating Temperature	—20℃ to 75℃
Storage Temperature	—30℃ to 100℃

Characteristics	3
Forward Current Derating Curve	
Operating Temperature	—40℃ to 100℃
Storage Temperature	—40℃ to 120℃

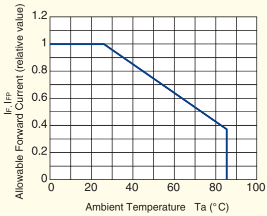
6. High-Brightness Green LED Lamps

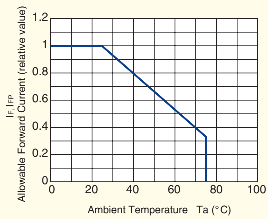
Series Name	Package Size (mm)	Viewing Angle 2Θ 1/2	Luminous Intensity Iv (mcd) @IF = 20 mA		Part Number	Typical Emission Wavelength IF = 20 mA		Lens Color	Guaranteed temperature
			Min	Typ.		λd (nm)	λp (nm)		
TL+H Series (InGaAℓP)	Oval 4.3 x 5	70°/ 50°	47.6	170	**TLGH28C(F)**	571	574	Green transparent	✻3
TL+E Series (InGaAℓP)	ø5	5°	2720	7000	**TLGE23TP(F)**	571	574	Transparent	✻3
			1530	5000	**TLFGE23TP(F)**	565	568	Transparent	✻3
			850	3000	**TLPGE23TP(F)**	558	562	Transparent	✻3
		18°	476	1300	**TLGE19TP(F)**	571	574	Transparent	✻3
			476	1100	**TLGE19CP(F)**	571	574	Green transparent	✻3
			272	800	**TLFGE19TP(F)**	565	568	Transparent	✻3
			272	800	**TLFGE19CP(F)**	565	568	Green transparent	✻3
			153	500	**TLPGE19TP(F)**	558	562	Transparent	✻3
		30°	85	300	**TLFGE18TP(F)**	565	568	Transparent	✻3
			272	700	**TLGE18TP(F)**	571	574	Transparent	✻3
			153	500	**TLGE18CP(F)**	571	574	Green transparent	✻3
			85	200	**TLPGE18TP(F)**	558	562	Transparent	✻3
		75°	27.2	90	**TLGE25TP(F)**	571	574	Transparent	✻3
		130°	8.50	20	**TLGE11TP(F)**	571	574	Transparent	✻3
			2.72	8	**TLPGE11TP(F)**	558	562	Transparent	✻3
	ø3	16°	476	1500	**TLGE50T(F)**	571	574	Transparent	✻3
			272	1000	**TLFGE50T(F)**	565	568	Transparent	✻3
			272	1000	**TLFGE50C(F)**	565	568	Green transparent	✻3
			153	600	**TLPGE50T(F)**	558	562	Transparent	✻3
		45°	153	400	**TLGE53T(F)**	571	574	Transparent	✻3
			85.0	200	◆ **TLFGE53T(F)**	565	568	Transparent	✻3
			47.6	130	◆ **TLPGE53T(F)**	558	562	Transparent	✻3
		80 °	47.6	155	**TLGE68TG(F)**	571	574	Transparent	✻3
			47.6	110	◆ **TLGE68CG(F)**	571	574	Green transparent	✻3
			47.6	110	**TLGE62T(F)**	571	574	Transparent	✻3
			27.2	70	**TLFGE68CG(F)**	565	568	Green transparent	✻3
			27.2	70	◆ **TLFGE62T(F)**	565	568	Transparent	✻3
			15.3	45	◆ **TLPGE62T(F)**	558	562	Transparent	✻3
		100°	15.3	45	**TLGE68DG(F)**	571	574	Green diffused	✻3
			15.3	30	**TLFGE68DG(F)**	565	568	Green diffused	✻3
		120°	15.3	50	**TLGE60T(F)**	571	574	Transparent	✻3
	Oval 5 x 5.8	30°/ 50°	85	250	**TLGE27C(F)**	571	574	Green transparent	✻3
	Oval 4.3 x 5	80°/ 50°	47.6	150	**TLGE28C(F)**	571	574	Green transparent	✻3
	Arched 5 x 2.5	10°	153	400	**TLFGE33CP(F)**	565	568	Green transparent	✻3
			272	800	**TLGE33CP(F)**	571	574	Green transparent	✻3
			476	1300	**TLGE33TP(F)**	571	574	Transparent	✻3

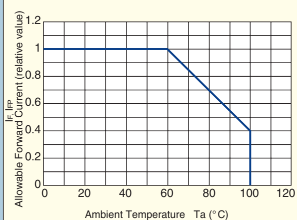
◆: Designed for flush mounting.
* When designing a circuit in which an LED is used, refer to the relevant technical datasheet.
Note: Refer to page 9 for information on pulse operation. Also, refer to page 3 for product number format.

@Ta = 25°C

Absolute Maximum Ratings		Package Dimension Number	Applications
DC forward current IF (mA)	Pulse forward current IFP (mA)(Note)		
50	200	Oval-2	Message boards
50	200	ø5-9	Pilot lamps (narrow range)
50	200	ø5-9	
50	200	ø5-9	
50	200	ø5-10	
50	200	ø5-10	
50	200	ø5-10	
50	200	ø5-10	
50	200	ø5-10	
50	200	ø5-11	Message boards Backlighting
50	200	ø5-11	
50	200	ø5-11	
50	200	ø5-11	
50	200	ø5-6	
50	200	ø5-7	
50	200	ø5-7	
50	200	ø3-3	Pilot lamps
50	200	ø3-3	
50	200	ø3-3	
50	200	ø3-3	
50	200	ø3-4	
50	200	ø3-4	
50	200	ø3-4	
50	200	ø3-5	Backlighting (wide range)
50	200	ø3-5	
50	200	ø3-2	
50	200	ø3-5	
50	200	ø3-2	
50	200	ø3-2	
50	200	ø3-5	
50	200	ø3-5	
50	200	ø3-1	
50	200	Oval-1	Message boards
50	200	Oval-2	
50	200	Arched-1	Backlighting
50	200	Arched-1	
50	200	Arched-1	

Characteristics	✻1
Forward Current Derating Curve	
Operating Temperature	−30°C to 85°C
Storage Temperature	−40°C to 120°C

Characteristics	✻2
Forward Current Derating Curve	
Operating Temperature	−20°C to 75°C
Storage Temperature	−30°C to 100°C

Characteristics	✻3
Forward Current Derating Curve	
Operating Temperature	−40°C to 100°C
Storage Temperature	−40°C to 120°C

4. Product List for the Through-Hole Type

Series Name	Package Size (mm)	Viewing Angle 2Θ 1/2	Luminous Intensity Iv (mcd) @IF = 20 mA		Part Number	Typical Emission Wavelength IF = 20 mA		Lens Color	Guaranteed temperature
			Min	Typ.		λd (nm)	λp (nm)		
TL✻U Series (InGaAℓP)	ø5	5°	1530	4000	TLGU23TP(F)	571	574	Transparent	✻3
			476	1600	TLPGU23TP(F)	558	562	Transparent	✻3
		30°	85.0	200	TLGU18TP(F)	571	574	Transparent	✻3
			27.2	90	TLPGU18TP(F)	558	562	Transparent	✻3
			47.6	180	TLGU18CP(F)	571	574	Green transparent	✻3
		45°	47.6	120	TLGU13CP(F)	571	574	Green transparent	✻3
			27.2	80	TLPGU13CP(F)	558	562	Green transparent	✻3
		55°	27.2	70	TLGU13DP(F)	571	574	Green diffused	✻3
			15.3	35	TLPGU13DP(F)	558	562	Green diffused	✻3
	ø3	10°	476	1200	TLGU50T(F)	571	574	Transparent	✻3
			153	450	TLPGU50T(F)	558	562	Transparent	✻3
		40°	47.6	170	TLGU53T(F)	571	574	Transparent	✻3
			27.2	80	TLPGU53T(F)	558	562	Transparent	✻3
			47.6	150	TLGU53C(F)	571	574	Green transparent	✻3
			27.2	70	TLPGU53C(F)	558	562	Green transparent	✻3
		50°	27.2	80	TLGU53D(F)	571	574	Green diffused	✻3
			15.3	40	TLPGU53D(F)	558	562	Green diffused	✻3
		80°	27.2	70	TLGU62T(F)	571	574	Transparent	✻3
			8.5	25	TLPGU62T(F)	558	562	Transparent	✻3
	Oval 5x5.8	30°/ 50°	47.6	180	TLGU27C(F)	571	574	Green transparent	✻3

Note: Refer to page 9 for information on pulse operation. Also, refer to page 3 for product number format.

7. Bluish Green LED Lamps

Series Name	Package Size (mm)	Viewing Angle 2Θ 1/2	Luminous Intensity Iv (mcd) @IF = 20 mA		Part Number	Typical Emission Wavelength IF = 20 mA		Lens Color	Guaranteed temperature
			Min	Typ.		λd (nm)	λp (nm)		
TL✻C Series (InGaN)	ø5	18°	1530	6000	TLGTC16TP(F)	505	496	Transparent	✻3
		25°	850	3200	TLGTC30TP(F)	505	496	Transparent	✻3
		33°	850	2500	TLGTC32TP(F)	505	496	Transparent	✻3

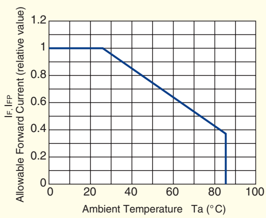
8. High-Brightness Dual-Color LED Lamps

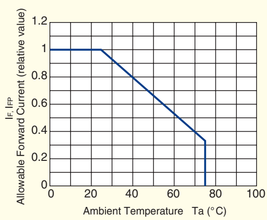
Series Name	Package Size (mm)	Viewing Angle 2Θ 1/2	Color	Luminous Intensity Iv (mcd) @IF = 20 mA		Part Number	Typical Emission Wavelength IF = 20 mA		Lens Color	Guaranteed temperature
				Min	Typ.		λd (nm)	λp (nm)		
TL✻H Series (InGaAℓP)	ø5	30°	Red	476	1100	TLRMHGH48T(F)	626	636	Transparent	✻3
			Green	272	500		571	574		
	ø5	40°	Red	272	450	TLRMHGH48M(F)	626	636	White diffused	✻3
			Green	153	220		571	574		

When turning on two elements simultaneously, keep the total current within the maximum ratings.
* When designing a circuit in which an LED is used, refer to the relevant technical datasheet.
Note: Refer to page 9 for information on pulse operation. Also, refer to page 3 for product number format.

@Ta = 25°C

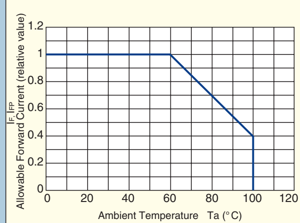
Absolute Maximum Ratings		Package Dimension Number	Applications
DC forward current IF (mA)	Pulse forward current IFP (mA)(Note)		
30	120	ø5-9	Pilot lamps (narrow range)
30	120	ø5-9	
30	120	ø5-11	Message boards Backlighting
30	120	ø5-11	
30	120	ø5-11	
30	120	ø5-5	
30	120	ø5-5	
30	120	ø5-5	
30	120	ø5-5	
30	120	ø3-3	Pilot lamps
30	120	ø3-3	
30	120	ø3-4	
30	120	ø3-4	
30	120	ø3-4	
30	120	ø3-4	
30	120	ø3-4	Pilot lamps (narrow range)
30	120	ø3-4	
30	120	ø3-2	
30	120	ø3-2	
30	120	Oval-1	Message boards

Characteristics	✻1
Forward Current Derating Curve	
Operating Temperature	−30°C to 85°C
Storage Temperature	−40°C to 120°C

Characteristics	✻2
Forward Current Derating Curve	
Operating Temperature	−20°C to 75°C
Storage Temperature	−30°C to 100°C

@Ta = 25°C

Absolute Maximum Ratings		Package Dimension Number	Applications
DC forward current IF (mA)	Pulse forward current IFP (mA)(Note)		
30	120	ø5-3	Pilot lamps (narrow range)
30	120	ø5-14	Message boards Backlighting
30	120	ø5-15	

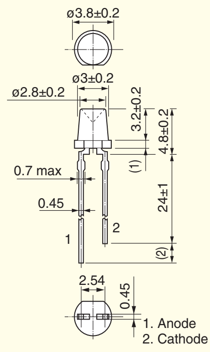
Characteristics	✻3
Forward Current Derating Curve	
Operating Temperature	−40°C to 100°C
Storage Temperature	−40°C to 120°C

@Ta = 25°C

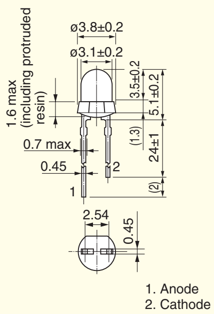
Absolute Maximum Ratings		Package Dimension Number	Applications
DC forward current IF (mA)	Pulse forward current IFP (mA)(Note)		
50 *	200	ø5-12	Message boards
50 *	200	ø5-12	

9. Package Dimensions

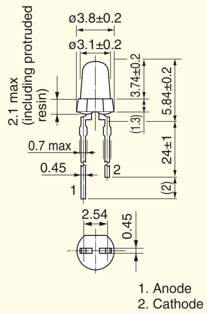
ø3-1



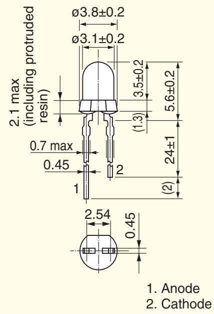
ø3-2



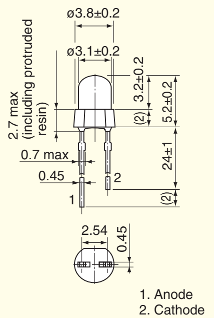
ø3-3



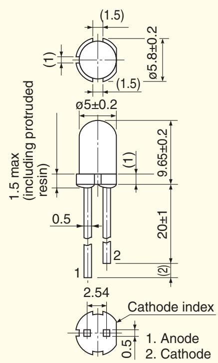
ø3-4



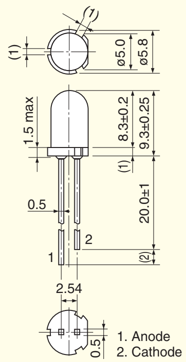
ø3-5



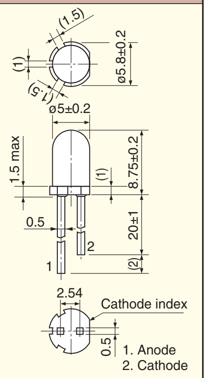
ø5-1



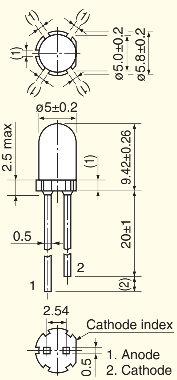
ø5-2



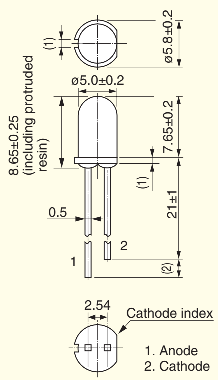
ø5-3



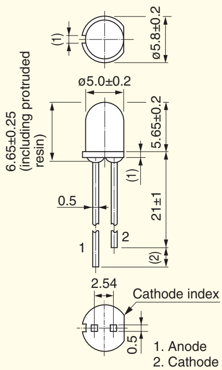
ø5-4



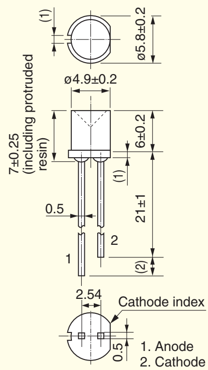
ø5-5



ø5-6



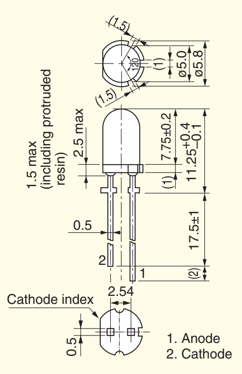
ø5-7



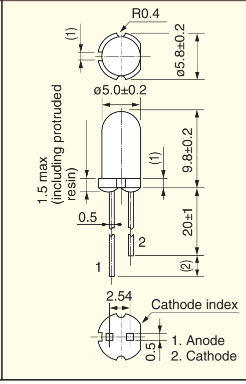
Unit: mm

ø5-8	ø5-9	ø5-10	ø5-11

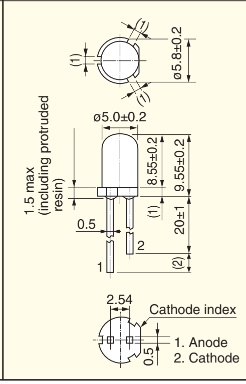
ø5-8



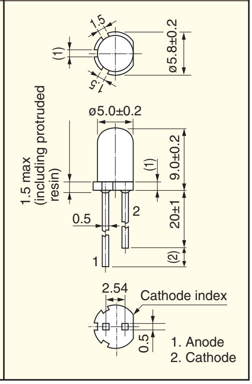
ø5-9



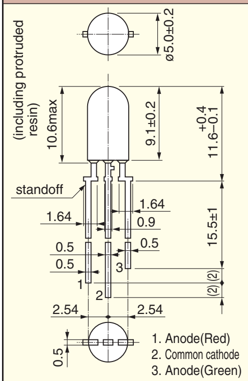
ø5-10



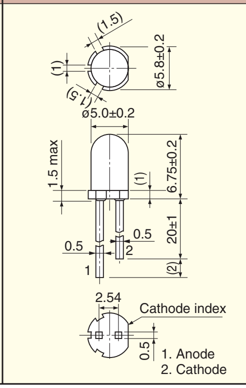
ø5-11



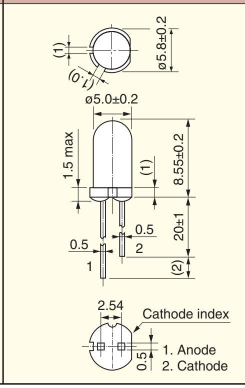
ø5-12



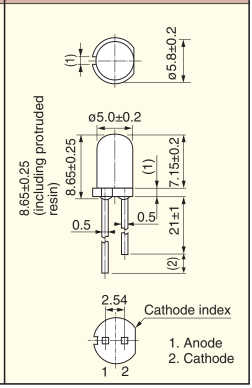
ø5-13



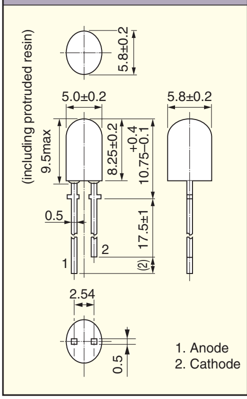
ø5-14



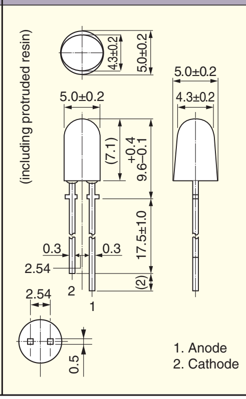
ø5-15



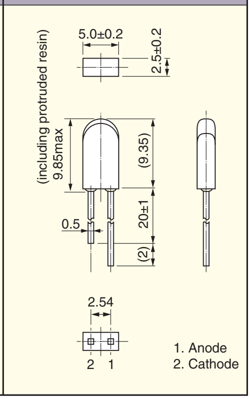
Oval-1



Oval-2



Arched-1



1. Through-Hole Type

1.1 Tape packing

- Designed for ø3- and ø5-mm through-hole type
- Available in tape and reel (spaced on 2.54 or 5 mm centers) suitable for automatic pick-and-place assembly
- Available in both ammo pack and tape & reel

Part Number Format

Example:

TLRE16TP (TPK51, F)

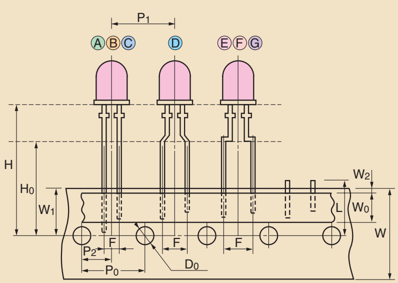
- TLRE16TP: Part number
- TPK51: Tape specification
- F: Lead-free lead finish

Tape Specifications

The following table shows available taped pack options classified by packaging type, tape dimensions and lead polarity.

Tape Specifications			Device Positioning on Tape (see the left diagram below)
Reel pack		Ammo pack	
Anode first	Cathode first		
TPK1	**TPKR1**	**TPK51**	Ⓐ
TPK3	**TPKR3**	**TPK53**	Ⓑ
TPK5	**TPKR5**	**TPK55**	Ⓒ
TPJ1	**TPJR1**	**TPJ51**	Ⓓ
TPJ2	**TPJR2**	**TPJ52**	Ⓔ
TPJ3	**TPJR3**	**TPJ53**	Ⓕ
TPJ6	**TPJR6**	**TPJ56**	Ⓖ

Dimensions for Device Positioning on Tape



Unit: mm

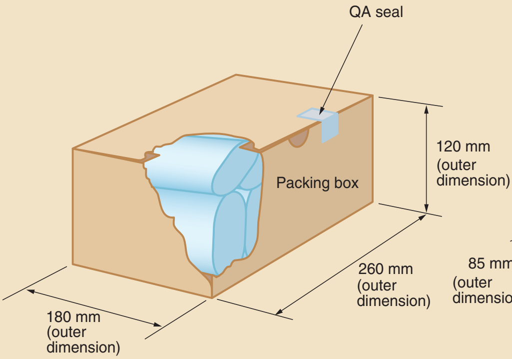
	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
H	23.35 ± 1.0	18.55 ± 1.0	17.0 ± 1.0	23.35 ± 1.0	20.5 ± 1.0	22.5 ± 1.0	23.35 ± 1.0
H_0	—			16.0 ± 0.5			
W	$18.0\ ^{+1}_{-0.5}$						
W_0	6.0 ± 0.3 or 13.0 ± 0.3						
W_1	$9.0\ ^{+0.75}_{-0.5}$						
W_2	0.5						
P_0	12.7						
P_1	12.7 ± 1 (component pitch)						
P_2	6.35 ± 1.3						
F	$2.54\ ^{+0.8}_{-0.2}$			$5.00\ ^{+0.8}_{-0.2}$			
L	11.0 max						
D_0	ø4.0 ± 0.2						

1.2 Bulk packing

For ø5-mm LED (standard)

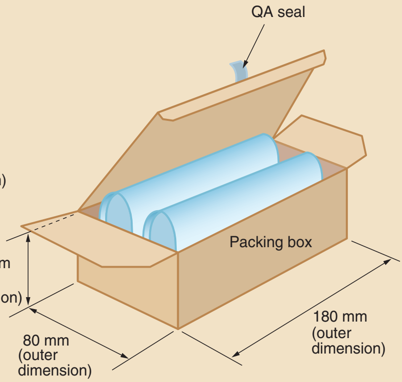
Minimum quantity: 500 pcs per bulk polyethylene bag

● Large box (standard)



10 bulk bags per large box (5000 pcs)

● Small box

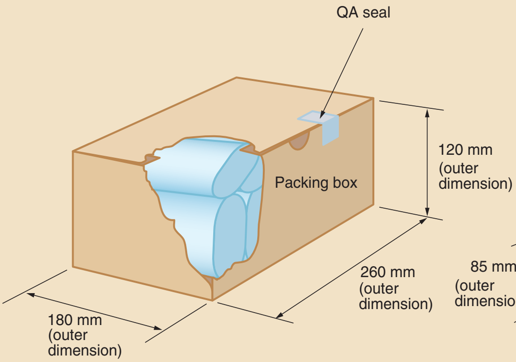


2 bulk bags per small box (1000 pcs)

For ø3-mm LED (standard)

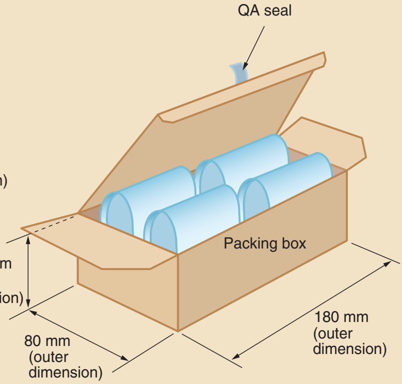
Minimum quantity: 500 pcs per bulk polyethylene bag

● Large box (standard)



20 bulk bags per large box (10000 pcs)

● Small box

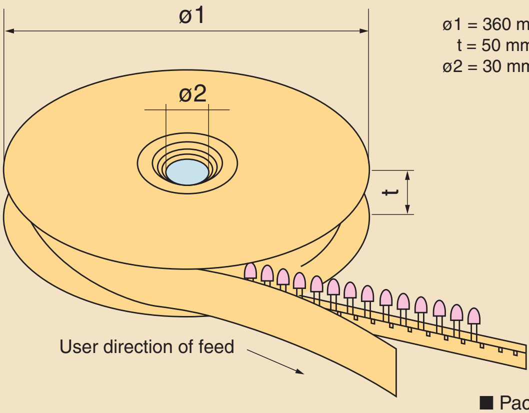


4 bulk bags per small box (2000 pcs)

1.3 Taped pack options

Reel Pack

■ Reel Dimensions



ø1 = 360 mm
t = 50 mm
ø2 = 30 mm

■ Packing Quantity

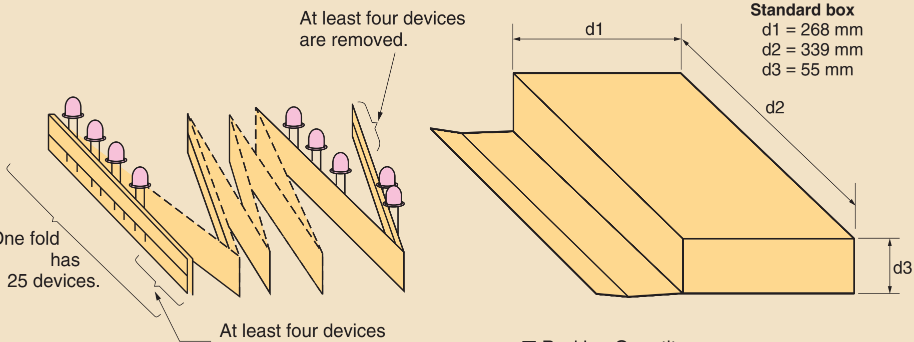
LED Type	Quantity per Reel
ø3 Series	2,000 pcs
ø5 Series	1,000 pcs

Ammo Pack

1. A tape is folded alternately, with 25 devices attached per fold.
2. The first and last folds have at least four devices removed.

Small box
d1 = 140 mm
d2 = 336 mm
d3 = 52 mm

Standard box
d1 = 268 mm
d2 = 339 mm
d3 = 55 mm



■ Packing Quantity

LED Type	Quantity per Reel
ø3 Series	2,000 or 4,000 *pcs
ø5 Series	1,000 or 2,000 *pcs

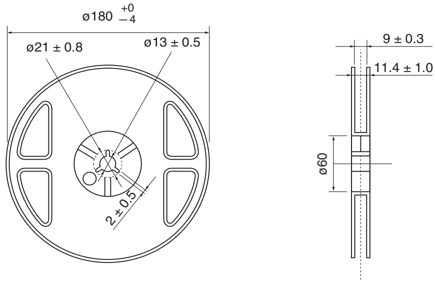
*: Typical quantity

2. SMD Type

Reel Dimensions

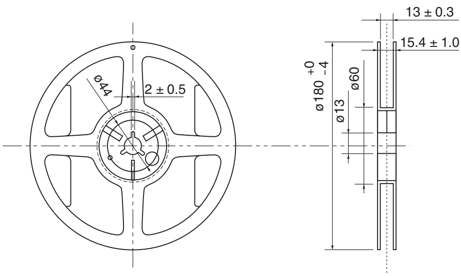
Unit: mm

T02, T03, T04, T05, T11, T14, T15, T18





T10



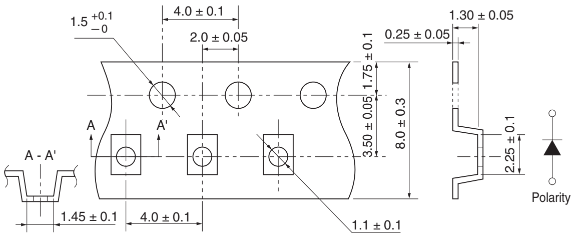


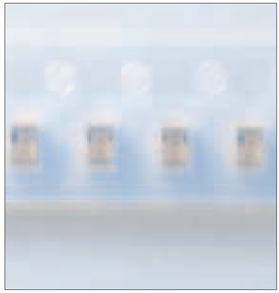
2. SMD Type

Tape Dimensions

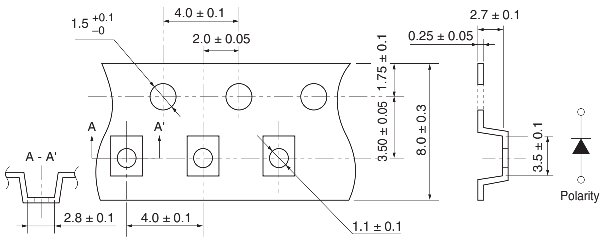
Unit: mm

T02



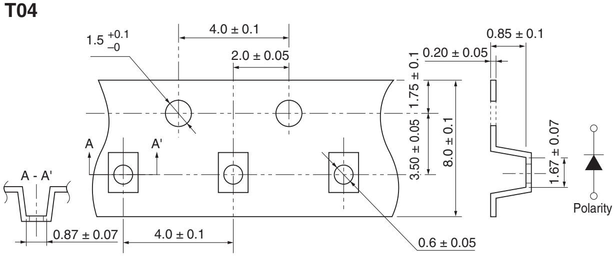


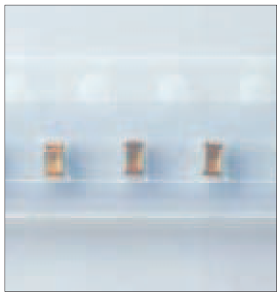
T03



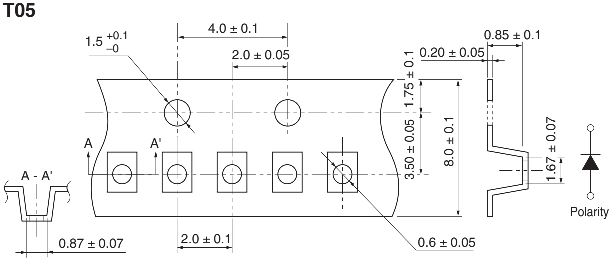


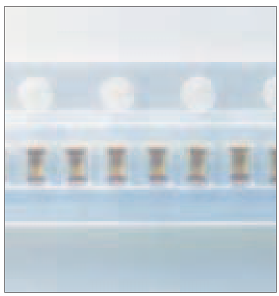
T04





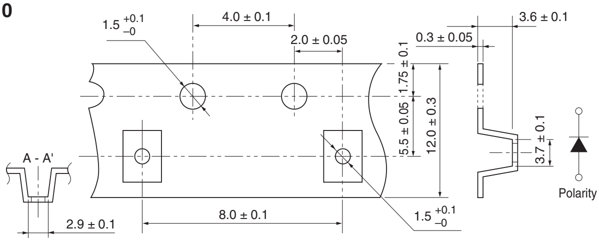
T05

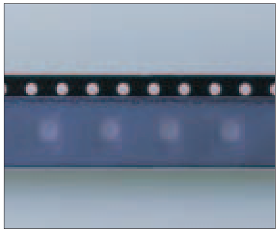




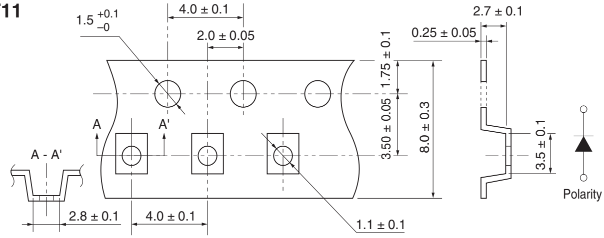
Unit: mm

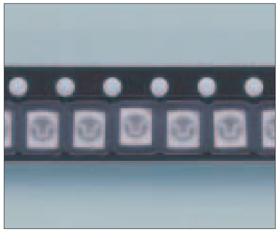
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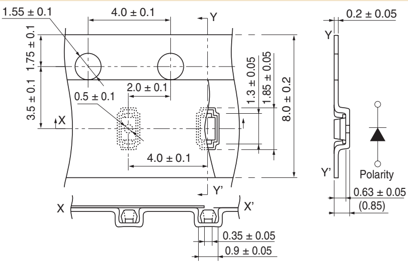


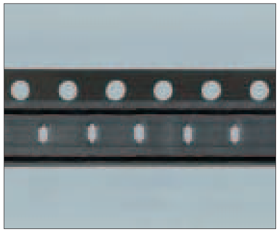
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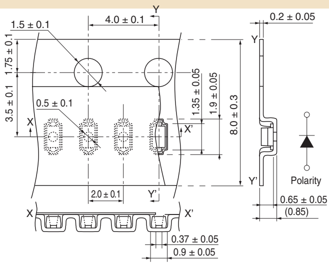


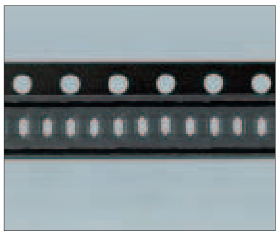
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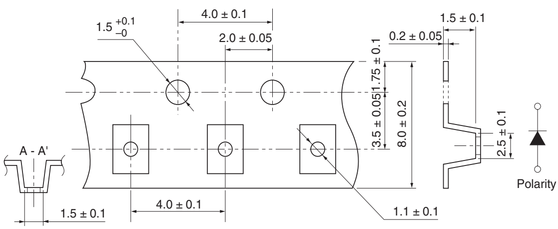


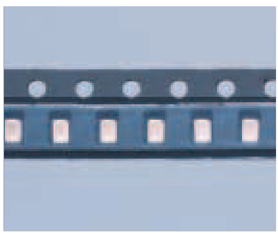
T15





T18





6. Handling Precautions

1. Through-hole Type

1.1 Mounting on a printed circuit board (PCB)

Soldering Conditions

Type of Soldering	Conditions	Precautions
Dip soldering	Solder temperature: 260°C max Dipping time: 3 seconds max Location: At least 2 mm away from resin body	● When the temperature of the device is rising, do not apply mechanical stress to it. ● During dip soldering, do not apply mechanical stress to the leads of a device; measures should also be taken to prevent any temperature rise in the device. ● You are advised to dissipate heat by gripping the leads with radio pliers or tweezers.
Manual soldering (using soldering iron)	Temperature at tip of iron: 300°C max Soldering iron capacity: 30 W max Soldering time: 3 seconds max Location: At least 2 mm away from resin body	

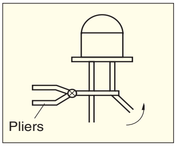
● **Soldering precaution for flush mount LEDs (suffix G to part number)**

Toshiba developed this type of LED for flush mounting onto through-hole double-sided PCBs. Compared with Toshiba's ø3-mm LEDs, the new LEDs are less affected by the mechanical stress that occurs during automatic mounting. However, if excessive stress is applied to the LED, the resin body may be damaged or the optical characteristics may become affected in such a way that the LED will not emit light. Before using the device, carefully read the precautions in the relevant technical datasheets.

1.2 Mounting precautions

Lead Forming

The lead frame should be bent at a point 5 mm away from the bottom of the body resin, with the base firmly fixed by means of radio pliers. Do not apply stress to the base.



Mechanical Stress on Leads

If stress is applied to leads during soldering, or if excessive stress such as tension, twisting or compression is applied to leads immediately after soldering, while the temperature is still high, the device may become open-circuited and then unable to perform according to its specifications. Instead, the positions and directions of leads must be corrected after cooling.

Cleaning

1) Ultrasonic cleaning

The resin body may be degraded if ultrasonic cleaning is conducted after soldering and a solvent is used to remove flux, or if non-recommended chemicals are used for brushing.

Note: The amount of stress applied to a device during ultrasonic cleaning will vary according to the size of the cleaning tank, the output power of the oscillator, the size of the PCB, and the mounting method. Confirm test results under actual conditions before starting cleaning in the production line.
Ultrasonic cleaning should normally be conducted with an ultrasonic output of 300 W or lower and should be completed within 30 seconds. These requirements may vary according to the size of the cleaning tank and the PCB.

2) Solvent

Depending on the solvent used, the resin body may be degraded. It is therefore necessary to confirm in advance that the solvent used for cleaning will not degrade the resin body. Also, the use of solvents containing freon is restricted so as to prevent destruction of the ozone layer. Before using any altemative cleaning agent, confirm that it will not degrade the resin body.

1.3 Reliability

InGaAℓP series LEDs are known for their high reliability compared with other LED devices and exhibit excellent characteristics particularly in high-temperature, high-humidity environments. However, before using these devices in equipment, be sure to perform adequate testing; in addition, include safety margins in design specifications.

1.4 Lead(Pb)-Free lead finish packaging

To protect the environment, Toshiba plans to convert to lead(Pb)-Free lead finish on four-element high-brightness through-hole LED lamps.

Part Number Format
Example : TLRE16TP (lead(Pb)-containing product)
TLRE16TP(F) (lead(Pb)-Free product)
For details, contact your local Toshiba sales representative.

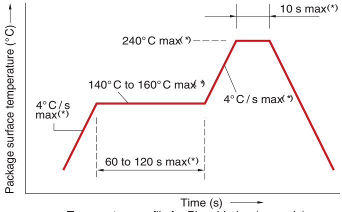
1.5 Four-element LEDs

This type of visible LED lamp also emits some IR light. If a photodetector is located near the LED lamp, ensure that it will not be affected by this IR light.

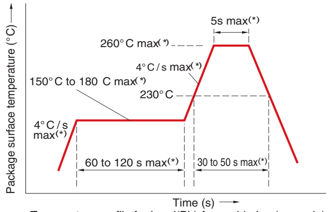
2. SMD Type

2.1 Soldering conditions: refer to the relevant technical datasheet.

Temperature Profile (reflow soldering)



Temperature profile for Pb soldering (example)



Temperature profile for Lead(Pb)-free soldering (example)
(TL✻✻1008A/1002A,1100B,1060/1106/TL✻✻1022/TL✻✻1032 Series)

The products are evaluated under the above reflow soldering conditions. No additional tests are performed for conditions exceeding the maximum ratings indicated. Be sure to perform reflow soldering under the above conditions.

Soldering Patterns

For series-specific soldering patterns, refer to page 10, 12, 14, 16, 18, 20, 22 and 24.

■ TL✻1002, 1002A Series, TL✻1005B Series, TL✻1008A Series

- The first reflow process should be performed under the above temperature profile within 168 h (within 72 h when performing lead(Pb)-free soldering) after opening the bag.
- If a second reflow process needs to be performed, it should be performed within 168 h (within 72 h when performing lead(Pb)-free soldering) from the first reflow under the above temperature profile.
- Storage conditions before the second reflow process: 30°C, 70% RH (max)
- Do not perform wave soldering.

■ TL✻1100, TL✻1100B Series, TL✻1060 Series, TL✻1106 Series

- The first reflow process should be performed under the above temperature profile within 168 h after opening the bag.
- If a second reflow process needs to be performed, it should be performed within 168 h from the first reflow under the above temperature profile.
- Storage conditions before the second reflow process: 30°C, 60% RH (max)
- If wave soldering needs to be performed, contact your local Toshiba sales representative. (Wave soldering cannot be performed for the TL✻1060 Series.)

■ TL✻1102B Series

- The first reflow process should be performed under the above temperature profile within 168 h after opening the bag.
- If a reflow process needs to be performed repeatedly, contact your local Toshiba sales representative.
- Do not perform wave soldering.

■ TL✻1022 Series, TL✻1032 Series

- The first reflow process should be performed under the above temperature profile within 168 h after opening the bag.
- If a second reflow process needs to be performed, it should be performed within 168 h of the first reflow under the above temperature profile.
- Storage conditions before the second reflow process: 30°C, 70% RH (max)
- If wave soldering needs to be performed, contact your local Toshiba sales representative.

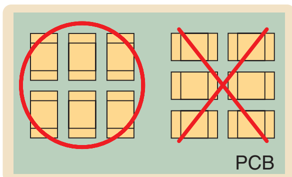
Manual soldering

Manual soldering with a soldering iron should meet the following conditions:
Temperature at tip of iron: 300°C (max)
Soldering iron capacity: 25 W
Time: 3 s (max) (only once at each soldering point)

2.2 Mounting precautions

- Do not apply mechanical stress to the resin body at high temperature.
- The resin body is easily scratched, —avoid friction against hard materials.
- When installing the assembly board in equipment, ensure that the devices on the board do not contact with other components.
- The mounting direction of the LED should be such that the direction of the LED electrodes is perpendicular to the long dimension side of the PCB. Design the PCB to minimize any stress that will be applied on the LED if the PCB warps.
- When the LED is mounted onto a flexible PCB, before using the equipment, ensure that there is no problem with LED reliability.

Mounting example



When cleaning is required after soldering, Toshiba recommends the following cleaning solvents. It is confirmed that these solvents have no effect on semiconductor devices in our dipping test (under the recommended conditions). In selecting the one for your actual usage, Be sure to perform sufficient review on washing condition, using condition and etc.



ASAHI CLEAN AK-225AES	: made by ASAHI GLASS
KAO CLEAN TROUGH 750H	: made by KAO
PINE ALPHA ST-100S	: made by ARAKAWA CHEMICAL
TOSHIBA TECHNOCARE (FRW-17, FRW-1, FRV-100)	: made by GE TOSHIBA SILICONES

2.3 Moisture-proof packing

These LED devices are packed in an aluminum envelope with a silica gel and a moisture indicator to avoid moisture absorption. The optical characteristics of the devices may be affected by exposure to moisture in the air before soldering and they should therefore be stored under the following conditions:

1. This moisture proof bag may be stored unopened within 12 months at the following conditions.
   Temperature: 5°C to 30°C
   Humidity: 90% (max)
2. After opening the moisture proof bag, the devices should be assembled within 168 hours in an environment of 5°C to 30°C/60% RH or below. (refer to the relevant datasheet.)
3. If upon opening, the moisture indicator card shows humidity 30% or above (Color of indication changes to pink) or the expiration date has passed, the devices should be baked in taping with reel.
   After baking, use the baked devices within 72 hours, but perform baking only once.
   Baking conditions: 60±5°C, for 12 to 24 hours.
   Expiration date: 12 months from sealing date, which is imprinted on the same side as this label affixed.
4. Repeated baking can cause the peeling strength of the taping to change, then leads to trouble in mounting. Furthermore, prevent the devices from being destructed against static electricity for baking of it.
5. If the packing material of laminate would be broken, the hermeticity would deteriorate. Therefore, do not throw or drop the packed devices.

2.4 Design precautions

Absolute Maximum Ratings

The absolute maximum ratings of a semiconductor device are a set of specified parameter values that must not be exceeded during operation, even for an instant. Moreover, one or more of the absolute maximum ratings must not be exceeded at the same time. For the ratings of a specific device, refer to the relevant technical datasheets.

Recommended Operating Conditions

The recommended operating conditions for each device are those necessary to guarantee that the device will operate as specified in the datasheets. If greater reliability is required, derate the device maximum ratings for voltage, current, power and temperature before using it. For details, refer to the relevant technical datasheets.

Temperature and Humidity Environment

Compared with electromechanical components, semiconductor devices are generally highly sensitive to temperature. Since the electrical characteristics of the device are subject to operating temperature, circuit designers must be fully aware of the thermal characteristics and may need to derate the ratings of the electrical characteristics. If the guaranteed operating temperature is exceeded, the electrical characteristics of the device may be irreparably altered and the reliability and lifetime of the device can no longer be guaranteed.

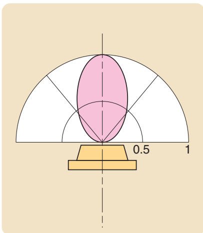
Viewing Angle

Each product has its own distinct viewing angle characteristic.

Select the product whose viewing angle characteristic best meets the requirements for the device in which it will be used.

The viewing angle is based on the angle Θ° between the axis on which the luminous intensity of light from the optical source is 100% and any axis on which the luminous intensity is 50%.

The angle between these two axes is referred to as the LED's half-angle value.
For the viewing angle of a specific LED, refer to the relevant technical datasheets.



Thermal Design

The failure rate of semiconductor devices greatly increases with operating temperatures. To achieve optimum reliability, observe the following precautions concerning thermal design:

- Keep the ambient temperature (Ta) as low as possible.
- If the power dissipation of the device is relatively large, select the most appropriate circuit board material, and consider using heatsinks or forced air cooling. Such measures will help lower the thermal resistance of the package.

Temperature Dependence

- Luminous intensity

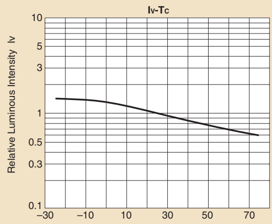
Because the recombination rate of the minority carriers in LEDs depends on temperature, the luminous intensity decreases as the temperature rises. To prevent a rise in LED junction temperature rise due to power dissipation, Toshiba recommends LED pulse operation or thermally enhanced packages. Before operating the equipment in which the LED is used, make sure that there is no problem with the equipment.

- Emitted color (wavelength)

As the junction temperature rises, the emission wavelength shifts to a longer wavelength. Toshiba recommends a thermal design that prevents junction temperature rise due to power dissipation.

Reference value: $\Delta\lambda = 0.2$ nm x ΔTj ΔTj: junction temperature

Example:
Temperature dependence of light output

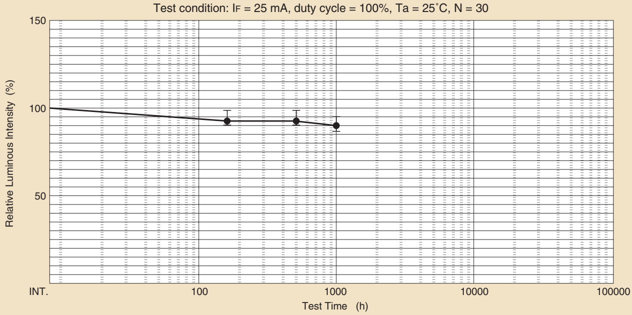


Light Output Degradation

The lifetime of the LED is affected not only by the longevity characteristics of the device, but also by the operating conditions and environment. Therefore, when selecting an LED and setting the operating conditions, it is recommended to check the longevity characteristics.

For product-specific reliability data including longevity characteristics, contact your local Toshiba sales representative.

TLOE1002A Change in Light Output During Operation Life
Test condition: IF = 25 mA, duty cycle = 100%, Ta = 25˚C, N = 30



2.5 Ultraviolet light in LED lamps: TLWH1100, TLWA1100, TLBGA1100, TLRPA1100

These products incorporate an ultraviolet LED (optical wavelength: approximately 360 to 400 nm); their output light therefore contains some ultraviolet light.
No problem shoud occur if the device is used for display applications. However, do not use the device under the following conditions:

- Prohibited - Where light condensed through lenses would cause eye damage
  For example, in microscopes and secondary lenses
- Caution - Where skin would be exposed to ultraviolet light over a long period with a distance of 20mm or less between the skin and LED, and an exposure time of 120 min or more
  - Where a photosensitive material would be used with the LED

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